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Electricity in Foundries.

WE visited a foundry recently in which not only were electric furnaces installed, but the handling equipment was also operated by electricity. In steel works for a number of years the application of electricity as a prime mover for such mechanisms as cranes, charging machines, ingot strippers, &c., has tended to simplify such machinery, with the result that the capacity of these machines has been greatly increased. Such developments have had a cumulative effect in the sense that the greater capacity of the machines has led to larger furnaces being installed; the average capacity of melting furnaces to-day is about twice that of those operating twenty years ago.

In iron and non-ferrous foundries development has not been quite so rapid, but steady progress has been and is still being made. Apart from the melting of metal, one of the most profitable uses of electricity in foundries is for drying cores. There are many different methods of core-drying practised in modern factories, and some of them are very primitive, costly, and only partially effective. For small repetition work, especially, the electrically-heated oven has important advantages; the cores are dried uniformly, and cores—and moulds—in one part of the oven are not baked harder than those in another section. In point of cost, it is questionable whether electric ovens are more expensive than gas- or oil-fired ovens. The cheapest method involves the utilisation of heat from the furnaces; but this is not always practicable, and it has disadvantages. Coal or coke may be comparatively cheap, but it is hardly possible to keep the temperature throughout the oven constant or uniform when using either of these fuels. In the case of a small oven, the expense of an attendant to watch the burner and temperature when firing with either gas or oil is high compared to the amount of moulds dried; whereas with electric heating no attention is necessary after the car has been put in the oven and the doors have been closed.

In electric ovens the length of time required is found by experience, and the oven is not operated on the most economical basis until the correct time to allow the moulds to bake has been determined. In a recent installation in an American foundry, electrically-heated ovens are used for cores varying from less than an

ounce to as much as 400 lb. each. Two of the ovens are of the car type, with capacity for a charge of about 24,000 lb., including the weight of the car; with this charge, each kWh bakes about 15 lb. of cores. Six ovens, somewhat smaller, are of the truck type, handling many of the larger cores, the trucks being charged into the oven by an electric tractor. Two smaller ovens are of the rack type, the cores being placed on individual racks, which then are placed in the oven and take the form of shelves along the walls. Each oven is heated by several banks of ribbon resistor units mounted on the side walls and in a pit beneath. Each side wall, as well as the pit, supplies about one-third of the heat. Each unit is rated at 3.8 kW on 110 volts, the necessary heating capacity of each oven being obtained by installing the required number of units. Temperature controls and electric contact regulators are used during the process, with automatic operation.

The annealing of steel castings is an important process that has certain similarities to core drying. Electric annealing ovens have as many points to recommend them as electric core stoves. The pit-type furnace is recommended by some because this style of oven keeps the annealed casting as free from surface oxidisation as possible and saves floor space. In such an oven the heating units may be of resistance ribbon wound on insulators built into the roof, with automatic control.

There would appear to be a very great future for electric ovens in foundries, and even in small foundries, for brass or iron, they have very much to recommend them. An all-electric small brass foundry, for instance, well managed, could probably be run more economically than one with coke- or gas-fired furnaces and clumsily improvised drying ovens.

An Electrical Shock Fatality.

ONCE more we regretfully draw attention to the danger incurred by the too intimate association of electricity supply circuits and radio receivers in unskilled hands. The trouble arises from the earth connection of the receiver of a crystal set, but as we have pointed out, unless proper precautions are taken, the risk is present in the case of valve sets also, especially when battery eliminators are employed and headphones are used.

Elsewhere in this issue we report the inquiry into the cause of death of a boy who, whilst using a crystal receiver in his bedroom, made contact with the live side of the lighting circuit and received a fatal shock. In this instance there is no evidence that the headphones were not in perfect order, but the victim placed in his mouth a wire connected with the crystal set; through defects in the flexible leads to a reading lamp the bedstead was made alive at 230 volts (the switch being unfortunately on the earthed side of the lamp circuit), and in the opinion of the installation engineer to the Newport Corporation, the accident was due to contact with the bedstead and the earthed wire.

It is noteworthy that besides the frayed flexible, the reading lamp was faulty, and therefore if the headphones had been defective the conditions would have been precisely the same as in the case recorded in our issue of June 3rd, which also had a fatal result; moreover, the fact that the switch was not on the live side would have made no difference if the reading lamp had been in use. Even if a three-pin plug and earthing wire had been provided, safety might not have been attained, for the earthing wire from the lead sheathing to a water pipe had been disconnected.

The Coroner recommended the periodical inspection of flexibles; we have advised inspection of the radio apparatus and the interposition of a transformer or condensers between the set and the headphones, and in view of the serious nature of the risk, we think the B.B.C. might well issue from time to time a warning against the simultaneous handling of domestic electrical apparatus and radio receivers.

The Overhead Lines Club.

IN response to Mr. R. Borlase Matthews's suggestion that engineers engaged in the construction of overhead lines should enrol themselves in an informal "Club" (ELECTRICAL REVIEW, August 19th, p. 326), with a view to pooling their experience and to promoting the extension of rural electric lines, applications for membership have been lodged with us in sufficient numbers to indicate that there is a real need for such an association to be formed. Some of the letters that we have received very emphatically welcome the proposal, and enlarge at some length upon the difficulties that are met with and the functions which could be performed with advantage by the club.

Whilst the constitution, organisation, and title of the proposed association will, of course, be a matter for the members to settle for themselves, in view of questions which have been put to us, we venture to state the position as we understand it. Mr. Matthews suggested that the qualification for "associate membership" should be the erection of over five miles of overhead line, and for "membership," of over fifty miles; subscription, nil; conditions of joining, to write to the Editors of the ELECTRICAL REVIEW, simply stating qualification for either class. Clearly, any engineer who possessed either of the above-named qualifications, whether a station engineer, contractor, manufacturer, or consultant, and whether employer or employé, would be eligible for election. At the moment the main thing is to ascertain the names of all those who wish to associate themselves with the movement, and we shall be glad to hear from them *as soon as possible*. Their applications will not commit them to any expense, or to any responsibility whatever.

Invention and Progress.

THE subject chosen for his instructive presidential address to Section G—Engineering—of the British Association by Sir James Henderson is one of the first importance to an industrial nation, and to the engineering profession in particular; as he said, invention is the heart of industry, the root of new developments, and the source of improved methods of production, and he questioned whether this country was doing its best to stimulate it.

Discovery is the aim of pure scientific research, conducted with a view to probing the secrets of Nature and bringing to light facts and principles which were previously unknown; hence it is essentially carried on by more or less random shots, guided only by the instinct of genius or by shrewd guessing, and often the discovery that is actually made has little or no relation to that which was expected. Thus Roentgen discovered the radiation to which his name is given, by a chance observation in the course of his experiments. Once the X-rays were known, inventors set to work to make use of them, thus profiting by discovery. Faraday, on the other hand, was actually seeking, diligently and with the insight of genius, for some connection between electricity and magnetism when he discovered what he sought—but he took little interest in invention, though he had opened the door for a multitude of inventors.

Another interesting case was that of the "Edison effect," observed and recorded by a great inventor but not followed up by him because he was concerned not with discovery but with invention; years afterwards Fleming, casting about for a rectifier, called to mind this phenomenon and made use of it by an act of calculated invention, the results of which have been indeed startling—on Sunday last we heard all over England music played and words spoken in Australia!

Hardly any discovery in natural science can safely be described as useless; in some cases apparently trivial phenomena have given rise to inventions of the first rank. Scientific research is essential to industrial progress, and every help should be given to the inventor, to enable him to make practical use of its products.

Swedish Railway Electrification.

Some interesting features of the Stockholm-Göteborg Railway electrification scheme, involving about 458 km. of main line, which was completed in May, 1926, and is supplied from the Swedish National electricity supply system.

WHEN in 1920 the electrification of the Stockholm-Göteborg line was sanctioned by the Swedish Parliament, it was decided that single-phase energy should be used for the railway, and that power should be taken from the National 3-phase distribution system. This decision was brought about chiefly by a consideration, in the light of tests carried out on the Nordmark-Klarälven railway, of the interference problem in connection with the telegraph and telephone lines. These have been placed underground between Stockholm and Göteborg, two cables having been installed, one for the railroad communications, laid along the railroad, and a second for the telegraph administration's long-distance circuits, laid along the country roads as far from the railway as is economically possible. The necessary overhead interurban and subscribers' lines have been moved away from the railway line.

These precautions did not entirely eliminate disturbance from the trolley wires, and it was found necessary to introduce a balancing circuit; this consists of a return wire carried on the trolley poles and connected to the rail at intervals of about 2.8 km. Midway between these connections "booster" transformers are installed, their function being to send the return current through the balancing circuit. Fig. 1 shows one of the booster transformers with its housing and connections. At the railway stations considerable difficulty was experienced with the balancing circuit on account of the extensive overhead network; but by means of a special by-pass circuit for the trolley current it has been possible to suitably arrange the return path.

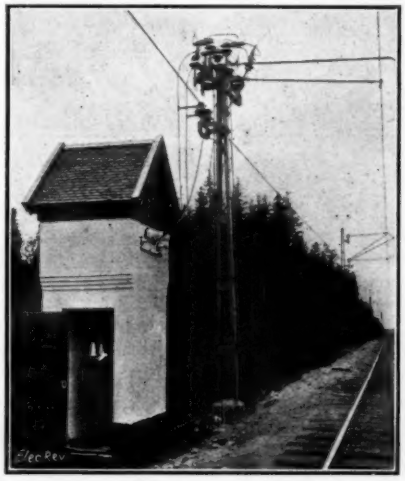


Fig. 1.—Booster-Transformer Station.

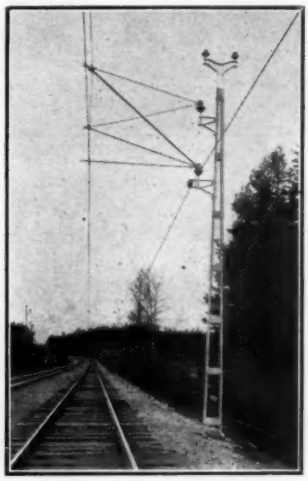


Fig. 2.—Double-Track Overhead.

Fig. 3.—Trollhättan Hydro-Electric Station.

The satisfactory solution of the interference problem has resulted in the removal of the limitation as regards the distance between feeding points, and the line-voltage variations have now become the determining factor in this connection. The National system interconnects the main power stations at Alvkarleby, Västerås, Motala and Trollhättan (fig. 3).

The railway supply is brought in at Södertälje, Sköldinge, Hallsberg, Moholm and Alingsås, where substations have been erected, and the three-phase supply is converted to l.f. single-phase at 16,000 V. The maximum distance between the convertor stations is about 125 km.

Work on the scheme was started in 1923; it required nearly a year to survey and mark the positions for the electric lines, plan the buildings, and order the electrical equipment. To accelerate the laying of the cables, an American trench digger was used. This was drawn by one of the most powerful steam locomotives employed on the railway. It is creditable that the whole of the cables were laid in six months.

The trolley-line construction is of the "Z" type which is used on the Northern Railway. The wires are carried on tubular iron supports which are equipped with automatic devices for regulating the trolley-wire tension.

Fig. 2 shows the overhead trolley wire on a double track, and fig. 4 the overhead arrangement at a station. The two insulators on the top of the pole in fig. 2 carry a circuit for supplying lighting, small power and signalling for the stations and other places along the line. Horizontally and directly above the track is the trolley wire, supported by an insulated arm. The lower conductor, carried on the side insulators, is the return circuit.

The trolley circuit is divided into 12 independent main sections, apart from minor sections, which are fed directly from the convertor stations. Södertälje and Alingsås each supply power to three sections, whilst the remaining three convertor stations feed two sections each. The convertor stations operate entirely independently of each other, and their line networks are separated by "dead" sections in the trolley system. The locomotives traverse these sections under their own momentum.

The greater part of the work, particularly the construction of the poles and the mounting of the insu-

lators and trolley supports, was done from one side of the line. Fig. 5 shows the open-air transformer station at Alingsås, to which the three-phase lines carry the power from Trollhättan at 130,000 V. In this sub-station the voltage is reduced to 6,300 V, at which pressure the current is conveyed to the adjacent enclosed sub-station, where it is converted by means of rotary machines and transformers to 16,000 V, single-phase.

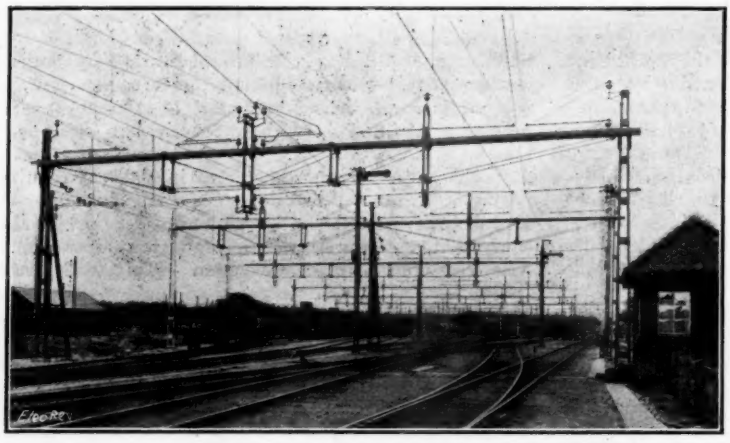


Fig. 4.—Overhead Equipment at a Station.

Fig. 6 shows the interior of the Alingsås convertor station; three motor-generators are installed, each consisting of a 6,300-V, 50-cycle synchronous three-phase motor driving a synchronous single-phase generator, 3,000 volts, $16\frac{2}{3}$ cycles. Each set can deliver continuously 2,400 kVA, or for short periods a 100 per cent. overload. Each set has its own exciter on the common shaft. Transformers, which raise the s.p. energy to the working pressure, 16,000 V, are housed in a separate compartment. The control gear is semi-automatic, and is operated from a switchboard equipped with one control handle for each motor-generator. The control of the circuit breakers in the outgoing lines is arranged from the same switchboard. These "educated" circuit-breakers are so arranged that when a short-circuit occurs in the trolley circuit, they automatically break and then again close the circuit after 30 seconds' interval, and if this is unsuccessful, again after a lapse of 3 minutes. If the second attempt at closing the circuit fails, an alarm signal is given, which indicates to the station *personnel* that a more or less permanent line short-circuit has to be investigated.

Below the floor level of the machine room is a basement through which the cooling air required for the motor-generators and transformers is taken in and distributed. In the basement is also installed certain regulating apparatus for the motor-generators which is controlled from the switchboard. The station contains a 30-ton electric crane for lifting and transporting the machinery during installation or repairs. In one corner of the machine room is installed a trap-door elevator, level with the floor, on which the outdoor transformers can be placed and lowered through the floor, so as to make their top parts accessible for inspection and repairs. The elevator machinery is capable of taking a load of 80 tons.

The express and passenger trains on the Stockholm-Göteborg line require locomotives with speeds up to 90 km. per hour, when pulling trains representing a weight of 500 tons. Likewise, for freight trains, representing a load of 900 tons, locomotives with speeds up to 70 km. per hour are required. The weight of the locomotive is not included in the above figures. The types of locomotive adopted are identical in external appearance, each being provided with three driving and two pony axles. Their maximum speed is 90 km. per hour, and the total weight of each is 79.5 tons. Each carries two motors, aggregating 1,700 h.p.

The driving units are gear-connected to a jack-shaft mounted in the frame level with the driving axles, to which the power is transmitted by means of coupling rods. By merely interchanging the gears between the motors and the jackshaft, an express locomotive can be converted into a freight locomotive, and *vice versa*, in a couple of days.

In the middle of the locomotive is a machine compartment, fig. 8, where, in addition to the motors, a transformer is installed for giving a supply at varying pressures for supplying current for auxiliary motors, lighting, and heating. In this compartment is a rack on which are mounted all the contactors, relays and switches required for operating the locomotive. There are also installed motor-driven ventilators for cooling the main driving machines, and a motor-driven compressor which supplies the air pressure required for the sand box, brakes, and so on.

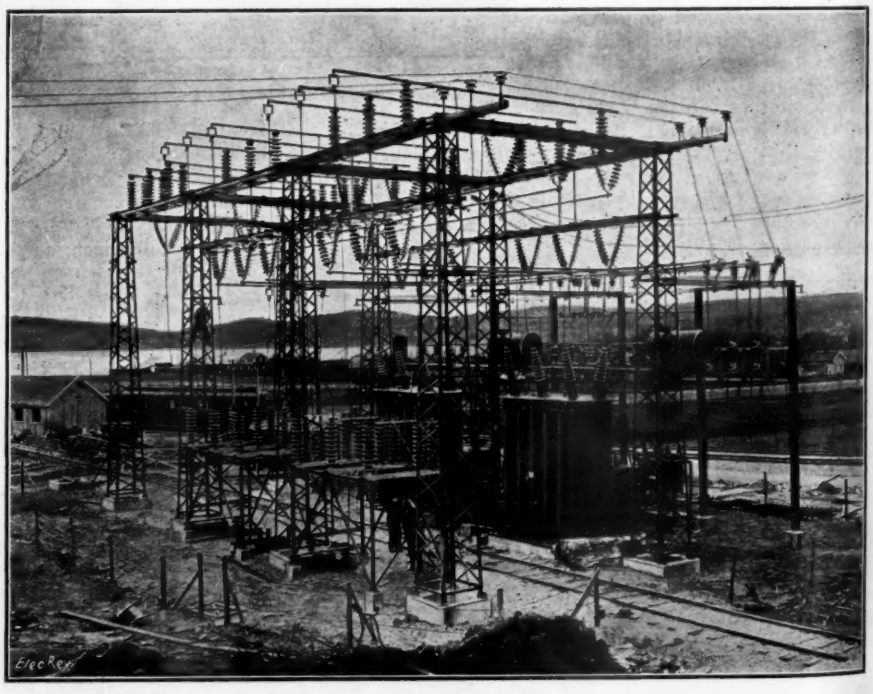


Fig. 5.—Alingsås Outdoor Sub-station.

Each locomotive is furnished at each end with a compartment for the driver, fig. 7, in which are mounted the control gear and the instruments. The power from the overhead system is taken through the

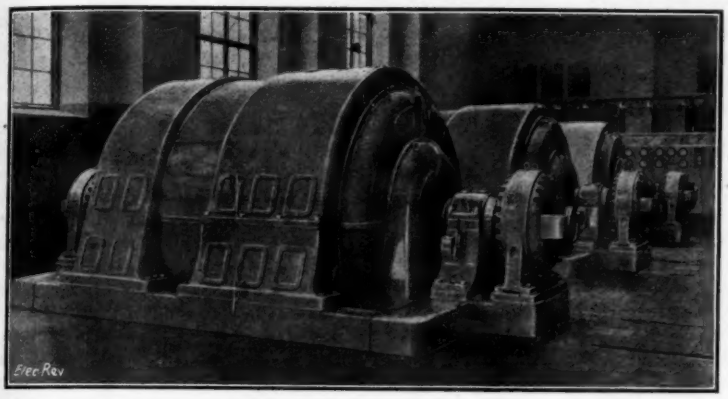


Fig. 6.—Convertor Station, Alingsås.

meters direct to the main switch in the machine compartment. From this it is conveyed to the h.p. side of the transformer and returns *via* the frame of the locomotive, the wheels, the track and the return conductor to the convertor station.

The main switch opens and closes the circuit and, on overloads or short-circuits in the locomotive, automatically breaks the circuit. This, however, creates some difficulties, since a short circuit in the trolley wire under certain conditions can give rise to a current of up to 2,400 amperes, and there is not sufficient space in the locomotive to accommodate a sufficiently large switch for this purpose. To overcome this difficulty

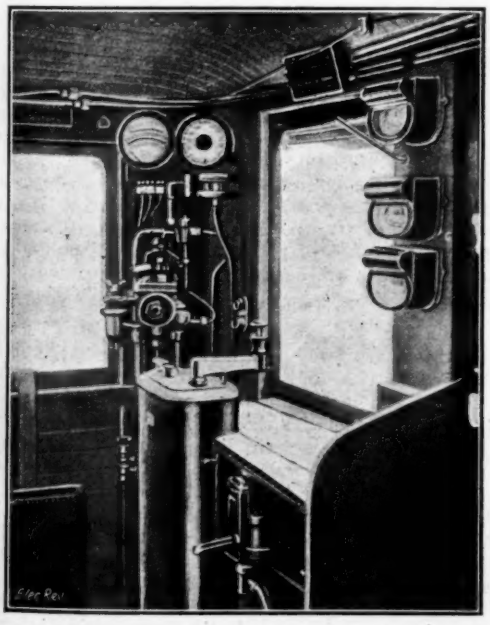


Fig. 7.—Driver's Cab.

several schemes have been adopted by various railway engineers, and the problem, as regards the Stockholm-Göteborg line, has been solved in the following manner.

The main switch is equipped with a maximum relay, which, on overload or short-circuit, operates but does not directly actuate the release mechanism of the main switch. Instead, it applies a potential from the transformer to another release relay, the function of which is to operate the main switch. If a very heavy short-circuit occurs in the locomotive, the potential applied to the release relay will be too low to open the main switch, and the "educated" circuit-breaker at the convertor will operate. When this happens the armature of the maximum relay in the locomotive returns to its original position and thereby opens the main switch by means of a mechanical release arrangement. When, after 30 seconds, the circuit breaker in the convertor station again switches on the power, the locomotive is open-circuited and the trolley current is automatically restored. The main switch in the locomotive, therefore, operates in such a manner that it opens for an overload and minor faults, but on heavy short circuits it leaves it to the heavier "educated" circuit breaker in the convertor station to perform the operation.

The starting controller is equipped with the "dead man's grip."

The first two locomotives were delivered in 1925, and were immediately sent to Norrland to be tested on the Northern Railway, where one hauled a train from Luleå to Narvik and back, and the other from Luleå to Vassijaure and back. The locomotives were then used in

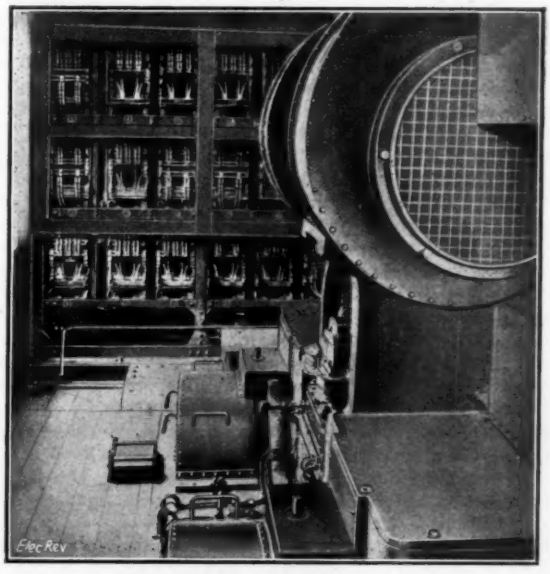


Fig. 8.—Machine Compartment.

ordinary traffic and made daily trips between Luleå and Narvik, and were only attended to at the Svartön depôt after having done 1,000 km.

The first convertor station at Moholm was put into operation in July, 1925, when a train was run between Moholm and Skövde, about 30 km.

The first electrically driven train left Stockholm for Göteborg in regular traffic at 12.40 p.m. on May 15th, and arrived on schedule time in Göteborg at 9.15 p.m.

Practically the whole plant is of Swedish manufacture, the principal contractors being the ASEA Company, of Vesterås, and only Swedish labour was employed.

The total cost of the plant is about £2,250,000, or £4,600 per km, and is made up roughly as follows:—Convertor stations, £250,000; overhead equipment, £800,000; cables and removal of telegraph and telephone lines, £600,000; and electric locomotives, £600,000.

It is interesting to note that the arrangements adopted for the elimination of the telegraph and telephone disturbances have proved satisfactory. By careful adjustment of the position of the return wire the disturbing voltage has been reduced to nil in the long-distance cable, and by one-half in the railway communication cable.

Rural Electric Lines.—IV. (*contd.*)

A Symposium of the opinions of electrical engineers experienced in the construction of overhead lines in rural areas, with examples of methods that have been, or are to be, adopted for the distribution of electricity at low and medium pressures.

Practical Details.

By W. FENNELL, M.I.E.E.

(*Concluded from page* 376.)

THE following technical details are intended to serve as a guide to the engineer who is willing to venture into the country, notwithstanding the legal and economic difficulties and the fact that he cannot hope to obtain a large revenue from the farmer at once, but must be ready to supply power, without reconstructing the line, when electro-farming has been developed by specialists.

The whole question of rural and country lines is at the moment in a condition of flux. There is no standardisation, and suggested voltages vary from 400 to 11,000.

System and Voltage.

There is one system and voltage which is clearly out of the question, *viz.*, 400-V, 3-phase, 4-wire. The cost of a .05 sq. in. line is about £350 per mile. Those who have run such lines for more than half a mile from the source of supply will regret it as soon as a cooking or power load develops, as the pressure regulation for such a line is abominable.

The highest voltage at which 3-phase, 10-h.p. induction motors can be made at a reasonable cost is about 1,000 V, and this would be quite a suitable pressure for a farming power line. The regulation would not be too bad for branches up to two or three miles, and the cost of transformers would be avoided for large farming motors. A voltage such as this is used in South Sweden. The writer would suggest further consideration for this pressure, *i.e.*, 1,000/600 V for 3-phase, 4-wire working up to, say, three miles, using the earth wire as a neutral, if permission can be obtained from the Commissioners, in which case single- or 3-phase auto-transformers might be used for stepping down from 600 volts to 230 volts. The ratio would be about three to one, which is ideal for the cheap construction and efficient working of such apparatus.

A 3-phase e.h.p. line of about .025 sq. in. section for 3,300 to 11,000 volts costs far too much (about £400 to £450 per mile) under the Regulations, while one of less section costs almost as much, because the thinner line wire involves the provision of taller poles to provide the standard clearance; and three-phase switches, fuses and transformers are expensive.

The writer is strongly in favour of single-phase distribution for rural work; all fusing and switching is s.p.—which is an enormous advantage—and the transformers are cheap and efficient, even in small sizes. A single-phase .025-square-inch line costs about £260 per mile and is of ample size for rural requirements, even at 3,300 volts, while at 11,000 volts it is much too large.

A 10-kVA transformer, having a low impedance drop, will supply a 20-h.p. motor for intermittent day use, and this is the largest size required for farming and estate work. As farm machinery is primarily arranged for driving from petrol engines, which have no starting torque or overload capacity, there is not much objection to single-phase motors, except their higher first cost and slightly lower power factor.

Estimates.

The following estimate gives the total all-in cost of a 5-mile line, presumed to run for one mile along the roadside, 2 miles across mowing grass or arable land, and 2 miles across uncultivated land. Ten tappings and transformers are allowed for, including three of 3 kVA (single-phase), four of 5 kVA (single- or 3-phase), and three of 10 kVA (single- or 3-phase), a total of 59 kVA for three systems, *i.e.*, 3-phase and single-phase to the Regulations, and single-phase to the suggested amendments of the Regulations, including the reduced ice loading and earth clearances, also the earthed return as detailed earlier in this article. The switchgear allowed consists of simple rod-operated isolators and horn break fuses, costing £6 per "line," including fixing; a switch and fuse to control a transformer on a single-phase line costs £6, while one to control a 3-phase transformer costs £18. Estimates are given for the line and equipment at (*a*) 3,300 volts, (*b*) 6,600 volts, and (*c*) 11,000 volts, but these do not, of course, include any low-pressure work.

Cost of a .025-sq.-in. Line 5 Miles Long with Accessories for Ten Tappings.

	Three-Phase.	Single-Phase.	
	To Regulations.	To Regulations.	To Proposed Modifications.
(*a*) 3,300 *Volts*—			
Cost of line	2,000	1,025	714
Cost of switchgear and pole sub.	172	660	60
Cost of transformers ...	289	195	195
Total	£2,461	£1,880	£969
(*b*) 6,600 *Volts*—			
Cost of line	2,100	1,075	764
Cost of switchgear and pole sub.	172	60	60
Cost of transformers ...	324	204	204
Total	£2,596	£1,339	£1,028
(*c*) 11,000 *Volts*—			
Cost of line	2,250	1,125	814
Cost of switchgear and pole sub.	172	60	60
Cost of transformers ...	341	252	252
Total	£2,763	£1,437	£1,126

The cost of local transformers and switchgear may be covered by a rental charge. The writer fixes this at 10 per cent. per annum on the capital cost for a special tapping for a consumer. Where a cluster of houses exists the charge is divided amongst the consumers up to five. When the number exceeds five the tapping is considered to be a low-pressure public main and the charges are borne by the Company.

Main-Line Tappings.

In dealing with an extensive area, it may be taken that there are two problems: first to get the supply into each district, and secondly to serve each rural sub-district. The main lines will usually need to be at 33,000 volts, otherwise there will be voltage-regulation difficulties. As these main lines will pass near villages it is necessary to arrange to tap them for local supplies and to step down for local rural lines. The writer has established a system for tapping a 33,000-volt line which brings the cost down to £50 for a single-phase sub-station and to £75 for one on 3-phase, excluding transformers; small transformers at high primary voltages are far too expensive to allow of 33,000-V lines being tapped economically for anything below 25 kVA. If primary mains are to be tapped for rural lines or large consumers, the cost must not be overlooked, and it is hardly likely to be reduced appreciably with safety.

Rural-Line Tapping Details.

For lower pressures suitable for rural distribution, say from 11,000 to 3,300 volts, the ideal tapping gear for local transformers is a simple hand-operated fuse oil switch. The cost of such switches for 3,300 volts is about £9 single-phase and £16. 10s. 0d. 3-phase. The type chosen by the writer is not made for above 3,300 volts and the cost of other makes appears to be

prohibitive. The author knows of nothing available for 6,600 or 11,000 volts at a reasonable cost, except a rod-operated air-break isolator which has a horn-break fuse for each phase; this has, perforce, been included in the estimate. He is of the opinion, however, that a rod-operated isolator is only a second-class substitute for an oil-immersed or an air-break switch, gear-operated, dealt with from the ground. The standard of continuity is not appreciably increased by fusing on the h.p. side of each transformer. If it is already properly fused on the l.p. side, the h.p. fuse only protects the line against actual transformer failure: but there should not be more than one failure per annum for every 10 transformers, and one can risk a cut off for the whole branch main once a year, especially as small fuses cannot be graded with certainty and the branch may still be disconnected, even if there is a h.p. fuse. The engineer must remove from his mind most of the ideas he has worked to on town and suburban systems using large transformers, each affecting hundreds of consumers and including large shops and public buildings. The country dweller will be far better pleased to have a supply on 364 days in the year at a reasonable cost than he will be to pay even £1 per annum extra on rent for apparatus, or to pay a higher price for electricity, to have it for the odd day.

Experience has shown that isolating switches operated from the ground by wires, rods, and so on, say one every mile-and-a-half in the line itself, are well worth while, and are a far more useful expenditure than the same amount of money spent on transformer protection. In case of a fault it can be located very quickly to its section by means of the line isolators, and at least some of the consumers can have a supply for that night. If the line can be looped, so much the better, as all but the faulty section can be put on in an hour or so, even in the dark. A few ground-operated pole switches save hours of time compared with many rod-operated switches which cannot be got at without ladders —and pole work is risky at night, or in a storm.

The Earth-Return Line.

It will be noticed that the only system which brings down the total cost to that necessary for rural work, *viz*: £250 per mile, including l.p. branches, is the single-phase line embodying the suggested modifications and including the earthed return, which has been advocated in and by the ELECTRICAL REVIEW for some years. This system has not been allowed up to the present in this country, due to a Post Office objection to earthing at more than one point. This objection is not understandable as applied to rural high-pressure lines where the current returning *via* earth would be limited to a very few amperes. Earthing at more than one point has been allowed on the huge Newcastle system, yet one can still telephone in the north of England! There are many tramways and some railways running with thousands of amperes returning by the earthed rails and the neighbouring pipes without any serious disadvantage, and it is hoped that the Post Office will withdraw its opposition, at least to the extent of allowing multiple earthing to be used on rural lines.

Pole Transformers.

A few words on pole transformers and their fixing may be appreciated by engineers. It is not, at present, sufficient to order a pole-type transformer without further specification. Most designers, unfortunately, do not realise the conditions of use. The lid should be fixed by only two eyebolts, not by 20 small bolts which cannot be undone without a couple of box spanners, one operating on the bolt head to prevent it from turning, and the other on the nut! A fairly large air space in the top of the transformer casing is better than a calcium chloride desiccator, if the lid is really air tight. Porcelain insulator terminals are better than glands for "tails," which nearly always leak. Always place the switch on one side of the pole and the transformer on the other. All insulators should be sealed into metal rings which are afterwards fixed to the case: a porcelain and metal joint cannot be made properly by rings under pressure. Always try to get the transformer pole near a road or footpath. It is trying in the extreme to haul a transformer across a ploughed field in winter, while in summer and early autumn it is expensive. Claims for damaged crops are usually felt to be extortionate, but few engineers can out-argue a farmer on his own ground!

Notices, Wayleaves, Erection Procedure, &c.

It is not proposed to detail the principles of line design, but there are certain matters relating to erection which may be touched upon. The first is that of notices. These must be given to the Electricity Commissioners, the local authority, and the County Council, when seeking their approval, and to the Post Office; also, of course, wayleaves must be obtained. It is good practice to send all the notices and applications at the same time and at the earliest possible moment after the route is chosen and the line is designed. It is better to allow all these time-absorbing processes to go on in "parallel" and not "in series." By this means a fortunate engineer *may* be able to start work within three or four months of the line being decided upon by his Council or Board. Always include in the plans, &c., the maximum length of line which may be needed in the eventual development, even if it is not certain that all will be carried out at first. It is very annoying to find, perhaps after work is commenced, that a fairly obvious extension is needed, and a further four months' delay is involved.

After obtaining wayleaves from the owner, it is not only a courteous, but a very wise, proceeding to call on the tenant, with the foreman, and show him the pole positions and arrange for routes of access to them. Note and mention any damaged fences and gates also at this time. Much irritation, some delay, and many doubtful claims arise as the result of workmen arriving and commencing the job without such an interview with the tenant. Some foremen have a way of ignoring the tenant, but this must be prevented, or if commenced, brought to a speedy conclusion.

In negotiating wayleaves, it is advisable to explain the public service which will be rendered by the line, and also to emphasise the importance of its being a fairly straight run. If an owner presses that the line shall zig-zag to follow hedge-rows, involving many angles and stays, because he is keen on keeping the poles off his arable land, it is advisable to point out the trees which will have to be cut and the stays which will be needed, and it should be suggested that both cutting and stays can be avoided by going straight across country. By taking a few extra long or short spans across country a line can usually be got through with most of the poles in hedges, although the line does not go along the hedge lines. There is a great deal of talk about tree cutting, but most of it is what is known as "guff." The farmer hates trees—because the roots impede ploughing and rob the land of his manure to grow timber for the owner, while the branches prevent what little sunshine we have in this country from reaching a fairly large area. On the other hand, the owner cherishes trees because they cost him nothing to cultivate, while he takes the timber. Far more damage is done to a tree by cutting its roots for underground cables than by pruning its branches for the passage of a few overhead wires. While it is much better to avoid cutting trees, it is often cheaper to pay the whole timber value of the tree (rarely over £1 or so) than to enter into arguments as to "damage by lopping."

Summary.

The preliminary work which has to be done at present can be reduced very much if the 1919 Act is followed more closely, both as to dealing with local authorities and with landowners. This needs an alteration in the Commissioners' procedure and a firmer line of action by the undertakers, substituting notices for bargaining. The electricity Regulations need easing for rural work, but it is useless to imagine that the suggested easement of the low-pressure Regulations alone will suffice, as nearly all rural work must be high pressure.

As the Regulations have almost prohibited any real rural development, there is not sufficient experience available to warrant new regulations being formulated as yet—but engineers should be allowed every latitude in carrying out designs which show some promise of reduced cost without seriously increased risk. In particular, earthed returns, less ice loading, and reduced line height should be tried out. The 4 per cent. voltage-variation limit should be increased to 8 per cent. at once for rural work. Single-phase working for branch lines is advocated as being the only system which brings the cost down to a possible figure for rural supply.

The Post Office should be urged by the Crown to deal equitably with electricity undertakers (who will render at least an equally important service to His Majesty's subjects in rural areas) and to refrain from applying antiquated memoranda as if they were penal codes. If its sectional engineers were given that discretionary power to which their training and position entitle them, and were instructed to ask for no more than is absolutely necessary in each particular case to secure safety, the writer thinks that a great improvement would result. We, as servants of the public, have a right to expect fair and even generous treatment from the Post Office which, after all, is only another public-utility service. The Post Office is, in fact, under a moral obligation to observe the Golden Rule.

No one disputes the obligation upon electricity undertakers to avoid endangering telephones; but to be pushed off the roads by arbitrary clearances, often twice or three times what is needed; to be ordered to pay for absurdly expensive protection, even for two forms of protection in series; to pay whatever is demanded without the right of inspection of the books or the control of the men working at one's expense, is a scandal; while to be told that the Postmaster-General is very lenient when he, as second comer, charges only half the alleged cost of some fanciful monstrosity termed a "protection," or of laying underground lines when his lines are brought near our existing lines, is just beyond the limit of what can be borne.

Resistance Amplifiers.

The importance of correct design: bad coupling units are less efficient than good transformers.

By PAUL D. TYERS.

RESISTANCE coupling for broadcast reception has now reached the stage at which the general public has come to the conclusion that it will give better results than can be obtained by the use of the more general audio-frequency transformer. Certain of the big firms, and more particularly the valve manufacturers, have done a large amount of pioneer work in popularising resistance coupling. In the early days of broadcasting, resistance coupling was considerably hampered by the lack of valves which would give a reasonable amount of amplification. Furthermore, loud speakers three or four years ago were, for the most part, hardly worthy of a really good amplifier, and accordingly it is not surprising that resistance coupling is only just coming into its own.

There appears to be an impression not only amongst the public but in the trade as well, that a resistance amplifier must *necessarily* give undistorted amplification; nothing could be farther from the fact. New resistance amplifiers and coupling units are coming on the market every day, and great care should be exercised in investigating them technically before making any purchase. Two resistances and a coupling condenser no more constitute a "coupling unit" than do two coils of wire and an iron core constitute a "transformer"; just as much careful technical design is necessary in the production of a coupling unit as with a transformer. The writer has already met one or two coupling units and amplifiers which do not give as faithful reproduction as a good transformer.

Let us consider very briefly the disadvantages which arise from the use of a transformer and then see if they are absent in the case of resistance coupling. Good quality of reproduction simply means obtaining equal amplification over a very large band of frequencies. A transformer tends to cut off the extreme "top," as the higher frequencies are usually termed, while exactly the same thing happens with the lowest notes or "bottom." In addition, certain resonances occur, tending to give peaks at various intervals along the scale. In the case of resistance coupling, these resonances are absent, since the coupling system contains no appreciable reactive impedance. But it does not follow that there will be no cut-off of either top or bottom. Cut-off at the top in the case of a transformer is due almost entirely to the self-capacity of the windings. Cut-off at the bottom is due to insufficient primary reactance, that is, too few turns. Cut-off in the case of resistance amplifiers, however, is not quite so obvious, although it is really perfectly simple to understand if one possesses a knowledge of Ohm's law and can apply it to a.c. cases. It would be out of place to consider any specific example in detail or to go fully into the subject of design, but by indicating the general nature of the problem, the important points should be made obvious.

The coupling system consists of two resistances and a condenser. The first resistance is in the anode circuit of a valve, and is shunted by the valve capacity; the high-potential end of this resistance is connected through a condenser to the grid of the next valve, which in turn is shunted to earth by the grid resistance or leak. Before endeavouring to examine the system in detail, it will be found convenient to redraw the circuit as a network of resistances and capacities and then see how a potential occurring in the anode circuit of the first valve causes a potential to be produced across the second resistance, that is, across the grid and filament. The resistance elements of the circuit alone will obviously behave in exactly the same manner at all frequencies, but since the circuit contains a condenser, this alters the case. Now it is well known that the impedance of a condenser is inversely proportional to the frequency which is applied to it; also, the smaller the condenser, the greater will be the impedance at any frequency. One immediately suspects, therefore, that if the condenser is on the small side, the reproduction is likely to be deficient in bass. This reasoning is quite justifiable as far as it goes, but what really counts is the impedance of the coupling condenser at the lowest desired frequency, when compared with the rest of the network and in particular the resistance in the anode circuit.

There are two systems of resistance amplification which are now generally used. The older method is to employ anode resistances which are of the order of two or three times the internal resistance of the valve, while the "high-resistance" system employs anode resistances of the order of megohms, the grid leaks in this case being almost of the order of tens of megohms. The

value of the coupling condenser is very different in the two cases. In the normal type of resistance amplifier, unless the coupling condenser is about 0.1 mfd., the lowest bass will be poor. In the case of the high-resistance method, however, it need only be between 0.005 and 0.01 mfd., depending upon the actual value of the anode resistance. The ratio of the impedance of the two condensers to the two anode resistances is about the same in each case, which, as previously pointed out, is the important consideration.

Another point which should be borne in mind is that of silence and constancy. Wire-wound anode resistances are preferable to high-resistance compounds, and when such are used, they should be fully investigated. Unless they are really suitable, they are apt to be noisy and spoil the background effect. The greatest difficulty with a high-resistance compound is that of making a good contact at the ends, while the value of the resistance of others is liable to change in course of time. For these reasons, wire-wound resistances are to be preferred, so long, of course, as they are non-inductively wound. Coupling condensers for ordinary broadcast reception need not be made of mica, high-voltage test paper condensers answering the purpose quite well. When one finds a cheap coupling unit with a mica condenser, it is as well to see that the condenser is big enough. If the unit employs the normal value resistances, it will be remembered that the condenser must be of a large size—and big mica condensers are expensive.

The Economics of Electricity in Italy.

Industrialists Attack High Rates.

(By Our Special Correspondent.)

THE question of the cost of electricity as applied to the manufacturing industries and agriculture of Italy has suddenly become acute. It is true that consumers of power on a large scale, like those upon a smaller basis, have long complained of the high tariff; but only now has the matter become of commanding importance owing to the strained economic position of the country to-day. A controversy of great interest to both producers and consumers of electric power is being carried on. That anything good, however, will emerge from these discussions is to be doubted; for it is sought to make clear that the lowering by the power companies of their tariffs (this being the main theme of the contending parties) is not at all probable. Cheap power for industry is recognised by Italian economists as the prime essential of recovery from the trade depression. It has been, however, the policy of successive governments (and not alone that of Signor Mussolini, as has been often unfairly proclaimed) to promote the wider use of hydro-electric power and subsidise electrical undertakings upon a heroic scale.

If a policy of State support be continued (at the time of writing there are unconfirmed rumours that the Administration intends to call a halt in the number and magnitude of the State grants accorded for the purpose), Italy will, before the end of 1930, be in possession of a well-organised electricity scheme (the nucleus of which, indeed, is already established) that should help to solve the problem of providing really cheap power.

Experience has proved in this, as in other countries of the world, that the lack of co-ordination among the supply companies has resulted in unnecessary expenditure of capital, wasteful consumption of coal, and generally higher charges for electricity than would have been the case had there been wider areas of supply, a greater concentration of generating plant in larger units, and more economically situated power stations. These factors have naturally reacted adversely on the application of electrical energy in industry, and still more so for agriculture. For the most part, however, they may be regarded as forming part of that necessary lesson which must be learned in connection with all new —or comparatively new—scientific enterprises.

It cannot be gainsaid that the position of Italy from that of a country predominantly agricultural and dependent almost entirely for its existence upon the produce of the earth, has been gradually altered by the employment of hydro-electric power. To-day, the Kingdom has been converted into a manufacturing country of some importance, a fact largely, if not wholly, due to the utilisation of water-power. During the past few years the improvement in agriculture and the development of manufacturing have marched side by side; many new industries have been brought into being, while old ones have been fortified by the adoption of motive-power. The present problem, however, is not so much the extension of these advantages to the whole country and the removal of the reproach of providing merely a regional hydro-electric service, as the lowering of the tariff rates so as to render the service available to all sections of the community. It seems strange, therefore, that the most acrid commentaries made about the policy of the hydro-electric companies as a whole, as well as against certain of those who have been responsible for its efficient and rapid development, should emanate from the agricultural classes for whose benefit the use of electricity has been so widely extended, especially in Northern Italy. But Southern Italy has derived advantages hardly less notable. In that region the rivers have very variable torrent-like flows, while their low-water period happens in summer when rains are very scarce. No one can doubt that hydro-electric enterprise in this section has served, and is serving, the large agricultural community most usefully. Besides a number of manufacturing industries, the general health of the population has improved owing to the fact that, by the construction of a modern system of channels properly laid out, large districts, such, for instance, as that served by the river Alcantarà (in Sicily), have been almost freed from malaria. The General Electric Company of Sicily (formerly the Società Elettrica della Sicilia Orientale) has constructed two electrical installations, by which a considerable quantity of water which used to be lost in the marshes, and served to promote the deadly disease, is now saved and utilised for generating electricity.

According to Signor Guido Semenza, pleading for fair treatment for both the producer and consumer of energy, the tariff for electrical energy during the war and for several years after did not follow, by reason of legislative restriction, the general upward movement of prices. Only during last year has the Government, recognising the anomaly of the situation, permitted, within certain limits, the revision of contracts. It is contended that with the present tariff the cost of supply does not exceed two and a half to three times the pre-war figure. In spite of this fact, however, and even allowing that a good part of the capital was subscribed

prior to the war, the companies, during the last few years, have been enabled to present good balance-sheets, and to make highly satisfactory distributions among their shareholders. It is, therefore, thought opportune to re-examine the relative position of producer and consumer. Not the least important factor has been the ability of the companies to obtain an abundance of new capital in the form of foreign loans; but another is that, during the last ten years, all electrical producing and distributing companies have made enormous progress in economies, small power stations being replaced by large ones, and the general joining-up of dispersed services allowing not only a better utilisation of power, but also an appreciable reduction in prime costs of production.

The producing companies, on the other hand, declare that their plants are in need of a complete overhauling. To bring them thoroughly up-to-date calls for a further large outlay of capital. This cannot be found unless the tariff rates are revised, from time to time, upon a reasonable basis. It is pointed out that the present tariff is not really high when, translated into gold, it is compared with the cost of energy in other countries. As regards the tariff for lighting, few countries quote lower rates than are charged in Italy. It should also be noted that new stations, regardless of the actual value of the lira, have cost much more than three times pre-war prices. The supply companies, therefore, ask of their critics whether it is not reasonable that all industries should make a small sacrifice in order that the electrical companies may overhaul their plants and obtain a regular and continuous service, eliminating possible damage caused by breakdowns.

The views of Engineer Semenza have not been allowed to pass unchallenged. Another prominent industrialist, Dr. Marcello Segre, has taken him to task with regard to his remarks that the tariff has not followed the general upward movement of prices. Dr. Segre declares that according to his experience, in the chemical industry, the price of power has risen more than any of the other factors which enter into the cost of production. He cites a specific case: L'Industria Nazionale Colori di Anilina, which has its works at Bicocca di Niguarda, entered into a contract with a hydro-electric power company in 1917, under which energy was to be supplied at 5.7 and 2.4 cents per kWh. When later on (in January last) there took place an amalgamation of several of the supply companies, the contract was revised, the basic price was placed at 25 cents per kWh, while other innovations brought the cost of supply to more than *six times* that of 1917. Dr. Segre goes on to say that if one takes into account the fact that the best English steam coal can now be bought at Genoa, on rails, at from 125 to 130 lire per ton, it becomes cheaper to import coal and operate machinery by steam than to use hydro-electric power; or to generate electrical energy in the factory. For the coal-dealer it is not necessary to pay down any sum of money in the form of a deposit; nor yet to guarantee to become a customer for a whole year—whether business happens to be good or bad. The quantity of coal purchased monthly can be used, or not, according to the necessities or to the particular interests of the purchasers. The subscriber to electric power, however, must guarantee the taking of a minimum quantity of energy, even if he does not need it.

To this frank statement upon the part of Dr. Segre, born of personal experience, Ing. Giacinto Motta, a well-known and influential electrical engineer, replies that while it is true that in January, 1927, the price was 25 cents per kWh, it has to be remembered, first, that the guarantee exacted was reduced from a minimum of 300 to 166 hours monthly; and, secondly, that the price itself was reduced proportionately to 18, 16 and 15 cents prior to arriving at 300 hours monthly. The difference between the maximum prices of the old and the new contracts, according to Signor Motta, would appear to be 4.4 times. But this is really not so. With the same consumption of 300 hours monthly calculated in the old contract, the new figure arrived at is a reduction to 3.7 (21 against 5.7). If the minimum amount of energy contracted for by the user is taken into consideration, the figure is further reduced to 2.4. Signor Motta then gives a comparative table of prices paid for each kilowatt-hour for light and power. Under the old contract during the three years of its life, the prices were 24, 18 and 10.3 cents; under the new contract the prices worked out at 24 cents in 1926 and 29 cents during the first six months of 1927. (During the last few months, however, the consumption having been reduced, the minimum price per kilowatt-hour is affected.) Assuming that these calculations are accepted, instead of 1927 prices being six times above those of 1917, as claimed by Dr. Segre, the figures show an increase of less than three times.

At the end of last year, the capital invested by both private companies and public corporations in the Italian electric power industry exceeded 7,500 million lire. Indeed, among the 2,000 odd enterprises, the capital invested was over 7,900 million lire if those with capitals of less than 1,000,000 lire are taken into consideration. For every 1,000 million kWh annually produced there has been a corresponding capital of 1,000 million lire invested, or, in other words, there has been a lira of capital for every kilowatt-hour. In the electrical power industry of this country the capital invested is higher than in any other, exceeding by more than 3,000 million lire the gross capitalisation of the industry ranking second in importance, namely, that of the metallurgical and mechanical trades in combination. Mr. E. A. Kerbaker, an accepted authority, declares that the intrinsic value of the hydro-electric industry of Italy is greater than the nominal value of its capital, which has not been increased in proportion because the most important companies have, in recent times, preferred to contract loans abroad, of which the combined amount is about 1,000 million lire; but this higher intrinsic value has reference to potential productivity and not to present production, because the funds obtained from the loans are being employed upon the enlargement of existing plants. There are now registered in Italy:—

*118 companies with a capital of from 1 to 9 millions	L. 349,901,000
62 companies with a capital of from 10 to 49 millions	L.1,126,200,000
16 companies with a capital of from 50 to 99 millions	L.1,040,000,000
21 companies with a capital of from 100 and more millions	L.4,986,250,000
Total	L.7,502,351,000

Nitrate Mines Electrification.

For the partial electrification of its nitrate mines on the Chilean Pampa the Anglo-Chilean Consolidated Nitrate Corporation is putting down plant at Coya Norte. The scheme will include the electrification of the heavy-grade section of the railroad running from the seaport, Tocopilla, to the mine. The power will be transmitted at 33,000 V, 3-phase, 60 cycles, to two 750-kW automatic railway sub-stations for converting the supply to 1,500 V, d.c., equipped by the General Electric Co., U.S.A.

As the ore is mined it will be handled by six electrically driven "Bucyrus" revolving shovels, each of which will have a dipper capacity of three cubic yards, and will be served by a motor-generator consisting of a 190-h.p. a.c. motor, and three generators having a total output of 150 kW. The three main driving motors on each shovel will be fed by the generators. The ore will be loaded by the shovels into trains pulled by 30-ton combination trolley and storage-battery locomotives, 500-V trolley and 190-V battery.

* These figures have been placed at the disposal of the writer through the courtesy of the American Chamber of Commerce, in whose "Year-Book for 1927" they appear.

The Local Agency.

Some Difficulties faced by the Manufacturer in building up his Sales Organisation.

By A. J. SMITH.

IN the increasing efforts which are being made everywhere to establish district "agencies" is to be seen an expression of the desire on the part of manufacturers for closer and more lasting connections with their principal trade customers than is possible when the relation is simply one of casual buyer and seller. Manufacturers in all trades have seen the advantages which they derive when there is a well-established trader in a particular district who has made a speciality of their product, to whom inquiries from users or private buyers can be referred, and who can be relied upon to ensure that of the business done in the district, the manufacturer whose product is specialised in gets his fair share—and preferably a little over!

Inducements.

With a view to such closer agency connections, many manufacturers are disposed to make a number of concessions, of which the following are typical examples: Inquiries received from users will be referred to the local agent, or he will be credited with commission upon any direct sales. Very often rival traders will not be supplied. The manufacturer will pay for considerable local advertising over the agent's name. Special exhibits are loaned for shows, and journeys undertaken either for the purpose of demonstrations or for clinching orders. Stock is often supplied upon sale or return terms. Sometimes the conditions of such an agency are set out in writing, but in many other cases there is a lack of any clear definition of some of the mutual obligations. Difficulties, it is often contended, can very well be settled when they arise; and under a loosely-defined arrangement they seldom fail to crop up, with the result that both parties are left with the impression that they have been badly treated.

Conflicting Interests.

In return for such concessions the manufacturer usually expects that the agent should sell only his own make of product, although the point may not always be stressed in the negotiations. Later on, it may be found that the trader holds a contrary view very strongly. The expense shouldered by the manufacturer in the way of costly demonstrations and district sales development work is now apt to be regarded as nothing more than what is naturally due to the trader, thanks to the "service" ideals which have received such publicity of late years. The benefits derived from having a number of machines supplied for stock would be considered as amply repaid by the provision of showroom space for housing them without rental or other charge. Advertising expenditure is looked upon as mainly in the maker's own interest, and so on. Though an agent will often regard it as nothing more than fair and reasonable that a manufacturer should confine himself to the agent for all sales in the locality, when it comes to the latter giving up his right to purchase the same class of goods in the open market whenever it may happen to suit his convenience, we find there is an unexpected clash of duty. The trader argues that he is bound by his own ideals of service to his customer to supply whatever make of article may be asked for, and though he may be ready to accept all the advantages accruing from an agency, he often betrays a decided reluctance to accept its concomitant limitations.

Some Results.

For lack of a clear understanding upon this point, many district agency arrangements are liable to become very one-sided affairs, and a manufacturer may upon occasion make the unpleasant discovery that though he is assisting considerably to finance a particular agent's business by the provision of stock and by payment for local advertising, a proportion of the resulting business is passing to competing manufacturers as the whim of a customer or the appeal of a slightly lower price may dictate. A manufacturer sharing the cost of a large advertising bill, demonstrating machines upon request to trader's customers, crediting the trader with commission upon all sales made in the district whether in respect of new machines, spares, or repairs, will find that in spite of all this his own make of machine is only one of several which are put forward when the agent is in touch with a probable order. In another case, a manufacturer who had contributed half the cost of an expensive exhibition, found his own product pushed out of sight in the background and unobservable unless specially sought for. On another occasion, after supplying an expensive machinery-in-motion exhibit for the stand of a local agent, a manufacturer found his own set merely one of half a dozen competing makes, all enjoying the open-handed hospitality of the same agent's stand!

A manufacturer has, of course, no cause for complaint when he is selling goods throughout the district to a number of traders. In such circumstances, just as he is prepared to supply any trader, so the individual trader is at liberty to offer any make of article he wishes; but the freedom of choice, which no one would question, as the right of a trader purchasing in the open market, has in common fairness to be modified if not relinquished entirely when a district "agency" is undertaken and a manufacturer's financial aid and the sacrifice of other connections accepted.

Usually there is nothing lost in the long run, by frankly facing the issues involved at the very commencement of any such sole agency or distributing arrangement, and having the mutual duties and obligations defined. The points to be watched by the trader are: If the manufacturer undertakes either to refer *user's* inquiries to the agent or to credit commission upon such business as may be done direct, does this undertaking also apply to orders or inquiries received from another *trader* in the district? Will the agent be credited with commission upon this business also, or what is the arrangement to be followed? The manufacturer on the other hand should have a clear understanding whether the agent will confine himself to the one make of article, or whether he expects to preserve the same free hand to sell any make as would an unattached trader.

Present-day Agreements.

A perusal of some of the latest types of agency agreement propounded, indicates that there is an increasing disposition on the part of certain very up-to-date manufacturers to withhold concessions to agents, and to make these contingent upon a certain volume of purchases. For instance, certain of the more expensive display matter will not be supplied until after a firm order has been received for the first machine or article. The amount spent in local advertising, the services of an expert for demonstrating in the district,

the training and tuition of the agent's own man, are all made entirely dependent upon the number and value of goods ordered for delivery at certain specified dates and subject to clearly-defined monthly cash settlements. Rebates (over and above the usual trade discount) are granted at the end of each year in accordance with the volume of business done.

Many such agreements, though eminently clear and to the point, betray evidence of being conceived in the clear legal atmosphere of a solicitor's office rather than in the give-and-take surroundings of ordinary commercial negotiations, and the undertakings they seek to impose upon a trader in the way of firm orders, clearly defined dates for taking delivery, and stringent cash settlements before any of the promised benefits materialise, are usually sufficient to deter the average steady-going trader from attempting to avail himself of their resulting advantages. But though there are obvious objections to some of the highly-scientific agreements which are now occasionally put forward, there is nothing lost in having a mutual understanding upon the subject of the mutual exclusiveness of any agency arrangement which is in contemplation, and which if generally followed would save both irritation and misunderstandings.

Timber for the Electrical Trade.

How to Avoid Waste.

By "ONE IN THE KNOW."

A GREAT deal of money is wasted on timber in the course of the year through firms not knowing how to purchase this expensive material in the most economical way. This is especially noticeable with electrical firms. Much time, too, is often wasted through the sometimes quite incomprehensible way in which orders for wood are made out; but this fault is not confined to those in the electrical trades. Even expert woodworkers, clever enough with their tools, are sometimes quite at loss when it comes to ordering the wood, with the consequence that the timber merchant receives an order closely resembling a cross-word puzzle, leaving him in an exasperating state of uncertainty as to what is really required. The result is that the order is delayed until inquiries can be made, and perhaps the customer has men standing still waiting for the wood. Money is being wasted all the time.

The fact is that, although timber is one of the oldest commodities in the world, there are few people who know much about it from a commercial point of view. At the present time all timber is very costly and, excepting the disastrous period of the war, hardwoods were never more expensive than they are to-day. Therefore a few hints in a general way and a little inside information may be helpful.

Generally speaking, electrical firms are not large consumers of timber, their demands being for quality rather than quantity. The chief demand is for teak, one of the most expensive woods, and it is usually required in some special size not kept in stock, which has to be cut to dimensions. That is where electrical firms often pay "through the nose" for their timber.

It must be remembered that all orders for *planed* woods are taken to mean *nominal sizes*. That is to say, 2 in. by 2 in. planed teak would actually be 1⅞ in. by 1⅞ in. It was 2 in. by 2 in. before being planed. Should it be required actually 2 in. by 2 in. when planed, the words "finished sizes" must be added to the order. Very few are aware of this, and many orders are executed wrongly (from the customers' point of view) in consequence, time and timber both being wasted. (American whitewood is the exception in this respect, as it is imported already planed to finish actual thickness.)

Again, when ordering one should always state the *quality* required. There are many grades of timber in all kinds, and failing to state the quality will render one liable to pay for "prime" quality when, perhaps, an inferior sort would have been suitable for the job. Timber merchants have a way of describing all hardwoods as "prime" if the customer does not state anything about quality on his order. If the purchaser does not know the quality required, he must state the purpose for which it is going to be used.

Unless one is prepared to throw money away, ordering by instalments should be avoided. Ascertain the quantity of timber required for one job, and present one order for it. This is not always possible, but many firms order, say, half a dozen boards of a special size necessitating, perhaps, the rummaging of a whole pile in order to obtain the size required, and then about an hour after they are delivered, the timber merchant receives a 'phone message asking if he can deliver two more of the same size boards. This means that the pile has again to be pulled down, as hardwoods are piled in mixed widths. Timber is not shifted about like packets of tea, and to pull down a pile of timber much labour and time is required. Labour is costly, and time valuable, *and the consumer pays for both.*

Mention should be made of a case where the small consumer of hardwoods often "pays through the nose" for timber. Electrical firms frequently require small pieces of teak, say, 6 ft. by 1 in. by 2 in. planed all round. The following week, possibly, another small piece is required, say, 4 ft. by 1 in. by 3 in. It is quite unlikely that the timber merchant will have anything near those sizes in stock, and very few timber yards keep hardwoods already planed. Therefore, those pieces would have to be cut out of a board and planed, which means that if the timber merchant has no mill at his yard, the wood has to be sent to a sawmill, perhaps a mile away. Imagine the "work" to be paid for on a little piece of wood. In the first place, hardwood sawing and planing are very expensive— quite different from softwoods; then there is the porter's time in taking it to the mill and waiting for it to be done, and, perhaps, the sawyer has other work in front of that; then bringing it back to the timber yard, to say nothing of the waste pieces which the timber merchant keeps, and the consumer pays for. More often than not the sawing and planing on a small piece of hardwood will cost more than the wood itself. If the purchaser is likely to require a few small pieces cut and planed to special sizes, he should buy the board and do the cutting and planing himself. Any workman with average intelligence, and a saw and a plane, should be able to "work" these small pieces out of a board at a quarter of the price charged by a timber merchant. Then instead of the timber merchant having the waste pieces, the purchaser would have them to use for another job.

Electricians cannot be expected to have expert knowledge of wood, so a hint may be given that should be remembered when selecting teak boards. Drop the board end-on to a stone or hard surface. If it is of "prime" quality, it will give a distinct and clear "ring." Should it give out only a dull sound, it is of inferior quality.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Radio at Prague Sample Fair.

Radio apparatus will be a special feature of the Sample Fair at Prague, Czecho-Slovakia, which is to be held from September 18th to 25th. More than 80 foreign and home firms manufacturing and dealing in radio apparatus will exhibit in the section.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during July last, were valued at £26,928, as against £36,933 in the corresponding month of 1926. The aggregate imports during the first seven months of the year are officially returned at £212,783, as compared with £258,407 in the corresponding period of last year, a decrease of £45,624.

The European Aluminium Syndicate.

This combination, which was formed provisionally for two years, has now been active for about one year and is claimed to have been able to bring about steady conditions in the European market and to maintain the selling price of 2,100 marks per ton, which was fixed just prior to the constitution of the syndicate. Before the starting of the German Inn aluminium works in 1926 Germany had import surpluses of 4,300 tons in 1924 and 6,400 tons in 1925. But in 1926, when the Inn works began to produce, Germany had an export surplus of about 7,000 tons, most of which went to the United States. As the inland consumption is very favourable, Germany has an import surplus again in the current year, this being of advantage both directly and indirectly to the other members of the syndicate as orders that cannot be executed by one constituent are passed on to another. In this way comparatively large quantities of French metal have recently been sent to the United States. As the North American production this year is estimated at 130,000-140,000 tons, or more than that of the combined European works, and despite price reductions, it has been impossible to increase sales in the American market, and it is considered that American material in considerable quantities will be offered in the European market sooner or later.

Local Exhibition.

HALIFAX.—An electrical appliances exhibition was opened on September 6th at the Corporation electrical showrooms, with cookery and other demonstrations in the morning and afternoon. The new extension of the showrooms is also open. The demonstrations include poster lighting, flood lighting, and shop window lighting, a special shop window having been fitted up and dressed by local tradespeople, with controlled electric lighting to show coloured lighting effects on goods displayed. The exhibition remains open until September 16th.

The Polish Electrical Industry.

Generally speaking, the electrical manufacturing industry of Poland only came into being in the years 1920-22. Since then and with the aid of high import duties the industry has been able to develop so as now to comprise almost all branches of electrical production. In general the consumption of electrical energy in Poland is still very small as compared with that *per capita* in other countries, but a considerable increase is predicted in the future in connection with the electrification plans which are now pending. It is stated that the home works are able to supply 75 per cent. of the requirements in machinery, plant, and apparatus. The imports, which are derived in the first place from Germany, are facilitated through the high Polish inland prices and the easier credit conditions granted by foreign competitors. The chief customers of the Polish industry are the railways, the army, the mining and iron industries, and other branches of industry. On the other hand the Polish export trade is still on quite a small scale.

During June last Poland imported apparatus, conductors, and other electrotechnical materials to the value of 3,380,000 gold zloty, and exported such goods to the value of 20,000 zloty.

New Italian Companies.

Among the concerns recently organised in Italy in connection with the electrical industry are the Società Fabbrica Nazionali Apparechi Telefonica, Milan, capital 200,000 lire; La Società Elettrica Agricola Industriali, Milan, capital 100,000 lire; La Società Applicazioni Razionali dell'Elettricita, Florence, capital 100,000 lire; and La Società Construzioni Elettromeccaniche Ing. a Loredan, Venice, capital 600,000 lire.

Cable Manufacture in Spain.

The inauguration has taken place of the cable factory at Maliano (Santander) constructed by the Standard Electric Company to supply the needs of the Spanish telephone service and to export to South America. The necessary copper will be obtained from the Cordova works and the lead from the Penarroya company.—*Reuter's Trade Service* (Madrid).

The Building Trades Exhibition.

On September 5th, the second Midland Building and Allied Trades Exhibition, organised by the Birmingham Chamber of Commerce, was opened at Bingley Hall, Birmingham, by the Lord Mayor. There are 72 trade exhibitors, and the display, which is of a very comprehensive character, fills the great hall. The exhibition covers a much wider field than its forerunner, held in 1925, and "recent progress" was the keynote of many of the individual exhibits, more especially in builders' plant and equipment, and in the sections devoted to heating, lighting, and modern sanitary arrangements. A wide range of woodworking machinery is shown in operation; this department makes one of the best features in a comprehensive exhibition. Structural steelwork, metal partitions and screens, and expanded metal for a variety of purposes, form another good section. The decorative arts are not represented by many firms, but the quality is of the highest. Builders' ironmongery and hardware present some new features, and in another section advanced methods of roadmaking and roadbreaking are shown, including rapid-hardening cement, concrete mixers, and the newest ideas in reinforcement. The uses of gas and electricity in the home, and for power purposes in workshops and factories, are demonstrated at the stands of the Gas and Electric Supply Departments of the Birmingham Corporation. The display by the City of Birmingham Electric Supply Department is of a comprehensive character. It includes an attractive range of electric lighting fittings and apparatus for the home, the "Utility" type electric fire, fitted with hob plate for boiling a kettle, and there are other types of portable fires. Attention is also directed to the tubular system of electric heating for churches and public buildings. An electric washing machine, complete with wringer, a water heater, fitted with thermostatic control, and a cold storage cabinet are also shown. There are also on the domestic side, a number of standard model cookers and vacuum cleaners, and demonstrations of electric cooking are given daily. On the industrial side, an interesting section deals with electric planes and drills, portable saws, sand-papering machines, and mortar mixers. The following lectures have been arranged under the auspices of the British Electrical Development Association:—September 8th, "Domestic Electrification," by Mr. V. W. Dale, and "Lighting and Power," by Mr. J. L. H. Cooper; September 15th, "Electricity for Architect and Builder," and "Electricity as a Means of Advertising," by Mr. J. W. Beauchamp. The exhibition will remain open until September 17th.

Brazilian Electrical Imports.

During 1926 electrical machinery valued at 23,793 contos of reis passed through the Port of Santos, states the *Board of Trade Journal*.

Belgian Trade with India.

The Commercial Secretary at Brussels (Mr. J. Picton Bagge) informs the Department of Overseas Trade that a co-operative society, to be known as "The Belgian Manufacturers' Corporation," has been formed for the creation of offices in British India for the sale in British India, Burma, and Ceylon of the goods manufactured by the associates and for all commercial operations intended to develop the export of Belgian products to India. A central office is to be opened in Brussels in order to carry out business, concentrate certain expenses, and permit of the rational solution of grouped shipments; to facilitate exports to India, and to create a service of commercial and industrial information concerning the Indian market. The capital is unlimited, but fixed at a minimum of 675,000 fr., represented by 135 shares, fully subscribed by 14 Belgian manufacturing concerns, the principal of which is the Ateliers de Constructions Electriques de Charleroi.

Steel Rebates.

As a means of stimulating the demand for their products, the principal British manufacturers of steel have decided to institute a system of rebates to customers who confine their purchases to British steel made by British labour.

D

New French Company.

La Société Centrale d'Appareils de Précision pour l'Electricité et la Mécanique is the name of a company which has recently been formed in Paris (5 Rue Godot de Mauroy), with a capital of one million francs.

A company has lately been formed in Paris (189, Rue du Faubourg Poissonière), with a capital of 150,000 fr., and the title La Société des Micas et Isolants, to manufacture mica goods and other insulating materials.

"Siemens-Xcel" Cabin Fires.

The P. and O. Steamship Co.'s liner *Narkunda* has recently been reconditioned and refurnished. In the equipment of the cabins, the comfort of the passengers has been given every consideration, and an exceedingly useful addition in over a hundred of the cabins is a "Siemens-Xcel" electric fire of a special design. These fires are beautifully finished in blue vitreous enamel, and as shown in the illustration, fig. 1, a neat hinged fretted guard, negotiable only by means of a special key, protects the two parallel elements. They are also fitted with a handle and a length of flex, so that they can be conveniently moved from one position to another, or fixed on the bulkhead by means of two brackets. They have a consumption of only 600 W. A view of a cabin with a fire in the centre appears in fig. 2. The P. and O. Co. proposes to equip other vessels of its fleet with the fires, which were supplied by Siemens Electric Lamps & Supplies, Ltd.

Fig. 1.—A "Siemens-Xcel" Cabin Fire.

Fig. 2.—The Fire in Use.

The Crompton-Parkinson Amalgamation.

In connection with the amalgamation of Messrs. F. & A. PARKINSON, LTD., Guiseley, Yorkshire, and Messrs. CROMPTON AND CO., LTD., Chelmsford, details are now to hand of the organisation of Messrs. Crompton Parkinson, Ltd. The removal of the entire accounts and sales departments from Salisbury House, London Wall, E.C.2, has been completed, and these departments are now located at the head office at Guiseley, from which address the policy and activities of the new company will in future be directed. We are informed that the existing well-equipped works will be maintained both at Guiseley and Chelmsford, and that under the new policy considerable improvements will be effected in organisation to ensure greater efficiency in manufacture. Additional branch offices have been established in all important centres, and the sales *personnel* of both organisations has been retained almost in its entirety. In keeping with the policy of decentralisation, the contracts and export departments remain at Salisbury House, London Wall, E.C.2. Telephone No.: London Wall 4734.

Industrial Designs.

The report on the Royal Society of Arts competition of industrial designs, 1927, states that the standard of the designs submitted showed a marked advance. Among the prizes was one for a design for an electrical fitting, presented by Messrs. Ackroyd & Best, Ltd. This was awarded to Mr. R. E. Edgcombe, Birmingham, for a glass pendant decorated with a classical design of Etruscan character.

New Australian Company.

Among the companies recently formed in Sydney is Dux Electric Heaters (World's Rights), Ltd., with a nominal capital of £250,000, to acquire for Dux Electric Heaters, Ltd., certain patents and designs, and to deal in machinery, &c.

Recent Contracts.

An order has been placed with Messrs. Worthington-Simpson, Ltd., by Sir Robert McAlpine & Sons for the complete electrically-driven pumping plant required by the Port of London Authority for the Tilbury Docks. This plant includes two impounding pumps 80 in. in diameter, each capable of handling 6,100,000 gallons an hour, two 60-in. dewatering pumps, each capable of handling 4,350,000 gallons an hour, and two drainage pumps, together with sluice valves, suction and delivery piping, and electrical equipment.

Among the orders for pumping plant recently secured by the MIRRLEES-WATSON CO., LTD., is one for a borehole pump for the Chiltern Hills Water Co., delivering 30,000 gal. per hour against a head of 242 ft., the drive being by a vertical a.c. motor.

EDISON SWAN CABLES, LTD., Lydbrook, has received an order for the supply to the Victorian Railways, Melbourne, of rubber-insulated cables and wires for one year. The order will call for over half a million yards of rubber-insulated cables in sizes ranging from 1/.044 in. to 37/.083 in. The same company recently supplied 10 miles of 19/.064 rubber-insulated braided cable with hard-drawn conductor for overhead use in Wellington, New Zealand. This cable was inspected and approved by the consultants, Messrs. Preece, Cardew & Rider. An attempt was made to break down a length of cable under high pressure, but the sample tested withstood 18,000 V without failure.

Trade Announcements.

Messrs. PETTERS, LTD., of Yeovil, state that Eng.-Lieut.-Com. J. K. Gibbon, R.N., of 19, Waterloo Street, Glasgow, is now representing them in Scotland. The arrangement under which Major R. McPhail acted as their representative terminated on August 31st.

Messrs. HENRY RIGHTON & CO., LTD., have opened an additional warehouse at 218, Pentonville Road, N.1, for carrying extensive stocks of brass, copper, and nickel-silver sheets, rods, tubes, &c.

Messrs. C. A. VANDERVELL & CO., LTD., announce that combined battery service agents for "Lucas," "C.A.V.," and "Rotax" have been appointed in the following towns:—Oldham, Hereford, Wigan, Kendal, Stafford, St. Leonards, Burnley, Lowestoft, Rochdale, and Stratford-on-Avon.

Messrs. WINGROVE & ROGERS, LTD., have acquired the broadcasting business of RADIO COMMUNICATION CO., LTD., whose products are sold under the trade mark "Polar." Messrs. Wingrove & Rogers, Ltd., are the master patentees of the "Polar" cam vernier coilholders and condensers, and a year ago they acquired the business of BRITISH ELECTRIC VEHICLES, LTD. Mr. W. Rogers, for many years with the Automatic Telephone Manufacturing Co., Ltd., will control the designs of Wingrove & Rogers, Ltd. Major G. D. Ozanne, formerly manager of Radio Communication Company's Broadcasting Department, and now London manager of Wingrove & Rogers, Ltd., will be in control of the wireless interests, in addition to his present duties. Lieut.-Commander L. H. Jeans, sales manager of the Radio Communication Co., Ltd., becomes sales manager. New offices have been opened at Arundel Chambers, 188-9, Strand, W.C. District depôts have been opened at Manchester, Glasgow, and Newcastle, and a wireless factory has been built at Liverpool.

The name of the PHOTECTOR CO., LTD., has been changed to "KORTING & MATHIESEN ELECTRICAL, LTD."; there is no change in the management or business policy.

We are asked to state that the business of the Gath Electrical Engineering Co., carried on by the trustees, is being wound up, and that Mr. J. H. Gath is carrying on the business of electrical engineer and contractor at Wards End, Halifax, under the title of the GATH ELECTRICAL ENGINEERING CO.

Mr. H. STANLEY SMITH, electrical and radio contractor, of 45, London Road, Hastings, has transferred his business to 7, South Colonnade, Marina, St. Leonards.

The undertaking of BOOTH BROS., electrical crane makers, of Leeds, has been acquired by Mr. George Baker and Mr. Sidney Baker, of John Baker & Co., Ltd., of Rotherham.

The ROTHERHAM CO-OPERATIVE SOCIETY, LTD., has opened a new department for electrical fittings and wireless components in Main Street.

New Catalogues and Lists.

MESSRS. E. N. BRAY, LTD., Whipps Cross Works, Wood Street, Walthamstow, E.17.—An illustrated price list of electric control gear, including motor starters, field regulators, and resistance units.

THE WHITWORTH ELECTRIC LAMP CO., LTD., 6 & 8, Gorleston Street, West Kensington, W.14.—A price list of electric wiring accessories, bells, and radio components. Reduced prices are given for v.i.r. and l.c. cables, conduit fittings, general lighting accessories, and valves.

THE WELSBACH LIGHT CO., LTD., 344-354, Gray's Inn Road, W.C.1.—Catalogue of electrical fittings, season 1927-28, containing illustrations and prices of lighting fittings, fires, cables, conduits, &c.

MESSRS. HANS RENOLD, LTD., Burnage Works, Didsbury, Manchester.—A price list of chains for industrial applications and cutting.

THE HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A mailing card, for the use of retailers, dealing with "Hart" motor starting and lighting batteries.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—Two showcards in colour advertising "Siemens" and "Silvalux" lamps, the former introducing an appreciative Scot and the other a fair lady. Both cards measure 18 in. by 12 in. They were accompanied by illustrated display matter available for the winter lighting season.

THE PARSONS OIL ENGINE CO., LTD., Town Quay Works, Southampton.—Two profusely-illustrated catalogues dealing respectively with the company's stationary oil and petrol engines and marine types.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—September calendar-blotter depicting the "unit" construction of the "Samson" coal cutter.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A catalogue (240 pp.) of lighting fittings, containing very numerous illustrations and full prices. The fittings shown include pendants, electroliers, ceiling fittings, bowls, lanterns, brackets, floor and table standards, &c. Each fitting bears a name for easy remembrance. The catalogue is handsomely bound, in blue, to form a companion to the company's general supplies and radio lists.

MESSRS. VERITYS, LTD., Plume and Victoria Works, Aston, Birmingham.—Publication No. 1,032, a comprehensive illustrated catalogue (80 pp.) of "Maxlume" industrial and commercial lighting fittings for all applications. Also two illustrated and priced pamphlets describing the company's electric fires.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—List No. W.215—a priced catalogue of cables and wires, illustrated by views of the company's works.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue P.221, illustrating and advertising "Prescot" single-phase electricity meters.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Catalogue Section A, containing very full details of "Cosmos" lamps of all types. Also a smaller publication (No. M.C.4502) of the same nature. Both lists are fully priced.

THE GREENWICH CABLE WORKS, LTD., Croom's Hill, Greenwich, S.E.10.—An illustrated pamphlet describing the company's "Pernax" bird shields for transmission lines, together with a sample of "Pernax" insulating material.

Catalogues Wanted.

Mr. J. G. D. B. MONTGOMERY, of 37, Charleville Road, London, W.14, who is opening business as an electrical engineer and contractor, asks for catalogues of domestic electrical appliances, wiring materials, accumulators, radio apparatus, machine tools, and many other lines.

The NATIONAL MANUFACTURING CO., who are just commencing business at 56, Coleman Road, Camberwell, London, S.E.5, as dry battery makers, and as wholesale factors for wireless components and accessories, wish to receive catalogues from actual manufacturers.

Messrs. LEONARD TOOMER & CO., 54, Lower Thames Street, E.C.3, wholesale electrical and wireless suppliers, ask for price lists of electric lamps, lighting accessories, radio sets, &c.

Bankruptcy Proceedings.

STEPHENS & WEILL, wholesale accessories merchants and importers of wireless accessories, 55, Great Eastern Street, E.—The first meeting of creditors was held on August 31st, at Carey Street, before Mr. D. Williams, Official Receiver, a receiving order having been made on August 18th, upon the petition of a creditor. The chairman reported that Simon Weill had attended under the proceedings, and had stated in the course of his preliminary examination that he was born in Germany, and came to this country in 1900. During 1906 he and his brother started business as manufacturing agents, chiefly representing French and German firms. His brother retired later, and in 1912 he (debtor) was joined in partnership by a Frenchman, who invested £1,200, and took a one-half share in the business, which shortly afterwards was converted into Weill Bros., Ltd., with a nominal capital of £5,000. The company was wound up in 1916. Weill next joined W. H. S. Stephens as manager of the latter's business, the Wholesale Accessories Co., and became a partner in 1920. The trading was successful until 1925, when heavy losses were made over German exchange in respect of German goods; also by paying in advance for German goods which were never delivered. In addition, bad debts to the amount of £20,000 were made in Germany and in this country. Owing to ill-health the debtor Stephens had been out of the business by mutual arrangement since last Christmas. The liabilities are roughly estimated at £20,000, and the assets comprise stock £1,000, and book debts £4,000 to £5,000. The meeting was adjourned for a fortnight to enable creditors abroad to send in their claims.

J. GLICKMAN, trading as the Manchester Radio Service Co., 10-14, Great Ducie Street, Strangeways, Manchester, wireless factor.—Receiving order made August 27th, on debtor's own petition.

W. H. WILSON, 1, Bryn Terrace, and Maesyllan Lane, Ruabon, Denbigh, electrician.—Receiving order made August 24th, on debtor's own petition.

H. C. HALL (trading as "The Pantechnicon"), 5, Alverton Terrace, and 5, Chapel Street, Penzance, electrical and fancy goods dealer.—Trustee, Mr. G. C. Hancock, Official Receiver, 12, Princes Street, Truro, released August 23rd.

F. SOMERFIELD, 85, Lichfield Road, New Invention, near Wolverhampton, electrical and mechanical engineer and contractor.—Trustee, Mr. S. W. Page, Official Receiver, 30, Lichfield Street, Wolverhampton, released August 23rd.

R. V. G. SELLERS, trading as "The Wireless Supplies and Installations," Town Hall Buildings, Banbury, wireless engineer.—Last day for receipt of proofs for dividend September 15th. Trustee: Mr. G. Mallam, 37, Cornmarket Street, Oxford.

J. G. SANDELL, 20, Hart Road, Dorking, electrical contractor.—First and final dividend of 1s. 10½d. in the £, payable September 14th, at the Official Receiver's offices, 29, Russell Square, W.C.1.

H. MILNES, trading as H. Milnes & Son, 8, Trinity Street, Huddersfield, plumber and electrical engineer.—Last day for receipt of proofs for dividend, September 13th. Trustee: Mr. A. Pontefract, 6, New Street, Huddersfield.

R. FENTON, 514, Sheffield Road, Chesterfield, electrical engineer.—First and final dividend of 3s. 6½d. in the £, payable September 14th, at the Official Receiver's offices, 4, Castle Place, Nottingham.

R. G. ROBERTS, Magnet House, College Road, Upper Bangor, Carnarvon, electrical engineer.—Receiving order made August 30th on debtor's own petition.

E. F. WOODGATE, 7, St. John's Terrace, Weymouth, electrical engineer.—Discharge suspended for two years from August 5th.

Company Liquidations.

SERENADA MANUFACTURING CO., LTD., 22, Paper Street, E.C.—The first meetings of creditors and shareholders were held on September 2nd at Carey Street, W.C., before Mr. J. B. Thompson, Official Receiver. The winding up order was made on the petition of the Eburite Paper Co., Ltd., creditors for £72, and accounts filed under the liquidation show liabilities of £3,205, and assets nil, leaving a total deficiency of £4,205. with regard to shareholders, the issued capital being £1,000 in ordinary shares. The chairman reported that the company was registered as a private one in December, 1924, to carry on business as manufacturers of and dealers in loud speakers and wireless components. The first and only directors were the promoter (S. H. Abrahams) and his wife, who were also the only shareholders. The company took over from Mr. Abrahams a lease, stock and fittings, in consideration of the 1,000 shares, and later a further stock of parts for making up into loud speakers, the sum of £2,000 being credited to the vendor's account from time to time as the goods were disposed of. Mr. Abrahams, in fact, financed the company, and was now a creditor for £3,133, that being the only debt apart from the claim of the petitioning creditors. He had offered to give post-dated cheques to the petitioners, but the offer was rejected. The company had incurred a net loss of £2,916, and in April last ceased to carry on business. A number of loud speakers had been sold under cost price, it being impossible to find a market for them. The failure was attributed to lack of demand for the loud speakers manufactured by the company which never had sufficient capital to develop on an adequate scale. In the absence of a quorum both meetings were formally adjourned, it being intimated that the liquidation would remain in the hands of the Official Receiver.

FULLER'S UNITED ELECTRIC WORKS, LTD.—Sir John Mann, the Receiver and Manager, states that he has now disposed of all departments of the company's business. Particulars of claims to be made by September 30th to Messrs. Mann, Judd, Gordon & Co., 8, Fredericks Place, Old Jewry, E.C.

BRISBANE TRAMWAYS CO., LTD., AND BRISBANE ELECTRIC TRAMWAYS INVESTMENT CO., LTD.—General meetings of the members of these companies will be held on October 3rd at the offices of Messrs. J. Fraser & Sons, 31, Copthall Avenue, E.C.2, to hear an account of the winding up from the liquidator, Mr. J. Fraser.

BRUNSWICK ENGINEERING CO., LTD.—Winding up voluntarily. Liquidator: Mr. H. C. Merrett, 41, Finsbury Square, E.C.2. Meeting of creditors, September 13th, at the Institute of Chartered Accountants, Moorgate Place, E.C.2. Particulars of claims to be sent to the liquidator by September 30th.

PEARLOTONE AMPLIFIER CO., LTD.—Winding up voluntarily. Liquidator: Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2. Meeting of creditors held September 6th. Particulars of claims to be sent to the liquidator by September 30th.

PRICE'S BATTERY & RADIO CO., LTD.—Meeting of members, October 3rd, at 77, Chandos House, Palmer Street, S.W.1, to hear an account of the winding up from the liquidator, Mr. E. Watts.

Private Arrangements.

ARTHUR CHARLESWORTH PEEBLES and ROBERT SHAW, trading as Charlesworth Peebles & Co., London and Glasgow, mechanical and electrical engineers.—A meeting of creditors was held on August 30th, at the Institute of Chartered Accountants, when the chair was taken by the representative of the "Z" Electric Lamp and Supplies Co., Ltd., the largest creditors.

Mr. S. H. Gillett, C.A., of 24, Basinghall Street, E.C., submitted a statement of affairs as at August 13th last. He said that the intention was originally to grant a moratorium with a view to the payment of 20s. in the £ to the unsecured creditors. This course, however, was later found to be impracticable, and the fact that two writs were issued brought matters to a head. Mr. Peebles commenced business at Glasgow in August, 1908, under the name of Charlesworth Peebles and Co. The business was carried on successfully until 1914, when Mr. Peebles joined the Army. Upon his demobilisation in August, 1919, he re-opened the concern and endeavoured to work up the agency business previously held. He found this practically impossible owing to trade depression, and he was compelled to look out for further agencies. In 1920 he became the sole agent in Scotland for the Condor Lamp Manufacturing Co., Holland, but no business could be done until 1921 owing to import restrictions. Mr. Shaw joined the concern as an assistant in 1920, and on April 1st, 1921, was admitted by Mr. Peebles as a partner, the capital of the partners on this date being: Mr. Peebles, £3,343; Mr. R. Shaw, £600. The lamp business grew to considerable dimensions, but in 1921 legal proceedings were commenced against the firm at the instance of the British Thomson-Houston Co., Ltd., on the grounds that the "Condor" lamp infringed the B.T.-H. patents. This litigation extended over a considerable period and adversely affected the turnover of the firm. Eventually, in 1925, a decision was given by the House of Lords in favour of Charlesworth Peebles & Co. Early in 1923 Mr. Peebles had moved to London, where he formed Condor Lamps (Gt. Britain), Ltd., of which he became managing director. This company became the principal agents in the United Kingdom for the Condor Lamp Manufacturing Co. In February, 1925, the company's business was acquired by Messrs. Philips, Holland, whereupon it went into voluntary liquidation. Mr. Peebles' engagement with the company terminated, and at the same time the firm of Charlesworth Peebles & Co. lost the "Condor" agency, which comprised the major and most remunerative part of its business. A branch office of the firm in London was opened in March, 1925. There was a loss on the working of the London business for the year to March 31st, 1927. Other causes of the present position were the small margin of profit obtainable, partly due to competition being very keen, and the heaviness of the working expenses; substantial losses incurred in respect of bad debts, the amount written off under this head for the six years to March 31st, 1927, being no less than £4,526; and loss incurred in respect of irregularities of a member of the staff. Mr. Gillett then gave particulars of the trading results. These showed that for the year to March 31st, 1922, there was a loss of £108; in the next year there was a net profit of £1,395; then there was a net profit of £1,885. All those figures related to the business in Glasgow. In the following year the net profit was £3,634 on the business in Glasgow and London. In the next two years there were losses of £13 and £5,944. For the period from April 1st, 1927, to August 13th, 1927, there was an estimated net loss of £1,982, before charging partners' salaries. The statement of affairs showed ranking liabilities of £9,215, of which £7,119 was due to unsecured creditors, and net assets of £6,771, leaving an estimated deficiency of £2,445. Mr. Peebles had rendered certain services to the Calgary Corporation, Ltd., in connection with the building of a railway, and the Corporation proposed to make a payment to Mr. Peebles of not less than £5,000. Mr. Peebles was prepared out of this money to pay over such a sum as would be required to make up 20s. in the £ to the creditors. The chairman advised the creditors to get the firm to execute a deed of assignment, and the assets could then be properly administered. This was agreed to, and Mr. Gillett was appointed trustee, with a committee consisting of representatives of the four largest creditors. The following are creditors:—

	£
"Z" Electric Lamp and Supplies Co., Ltd.	1,619
Siemens - Schuckert (G.B.), Ltd.	1,539
Metro - Vick Supplies, Ltd.	586
Philips Lamps, Ltd. ...	443
Friho Mfg. Co., Ltd. ...	413
General Electric Co., Ltd.	346
Hartman & Co.	317
Electric Cables, Ltd. ...	166
Quickfix Electrical Fittings Co., Ltd. ...	161
Kersons Mfg. Co., Ltd.	143
Crabtree, J. A., & Co., Ltd.	140
ELECTRICAL REVIEW ...	138
Morrison & Gibb, Ltd.	135
Hecht & Co.	106
N. Lloyd & Co., Ltd.	85
Wootton & Co.	69
Dixon, Wilson, Tubbs and Co.	62
British Thomson-Houston Co., Ltd.	46
Grothe, A., & Sohne, W.	42
General Accessories Co., Ltd.	41
Stella Conduit Co., Ltd.	39
Underwood (Manchester), Ltd.	39
Hinkel, E. P.	35
Dwyer, P. L., & Co.	27
Allen Lithographic Co.	27
Mannemanrohren-Lager Anglin & Co.	24
Midland Electric Mfg. Co., Ltd.	24
Siemens & English Electric Lamp Co., Ltd.	20

FREDERICK WATKINSON (deceased), late 329, High Holborn, W.C., electrical engineer, &c.—A meeting of creditors was held at Anderton's Hotel, Fleet Street, E.C., on September 1st, when it was reported that the liabilities were in the neighbourhood of £5,000, including a claim by the bank of £1,200, while the assets totalled £1,585. Mr. Rowlands, solicitor, said that the debtor died about a fortnight previously, and owing to pressing creditors an originating summons was applied for and was obtained. Recently an execution was levied on the debtor's showroom, and goods to the value of £500 were sold for about £150. The creditors appointed Mr. Bateman, of Messrs. M. Bateman & Co., 28, Brook Street, as receiver of the estate and a committee of inspection was appointed, consisting of Mr. G. G. Poppleton, of Messrs. Poppleton and Appleby, and another trade creditor.

F. G. BUCHER, trading as Stewart & Bucher, plumber and electrician, 10, North St. Andrew Street, Edinburgh.—A meeting of creditors was held recently, when a statement of affairs was submitted which disclosed liabilities of £10,690, including unsecured creditors for £9,262, and net assets of £1,500, leaving a deficiency of £9,190. The statement thus showed an apparent dividend of 2s. 10d. in the £, subject to the expenses of realisation. It was stated that a trust deed had been executed in favour of Mr. J. S. Wells, accountant, Edinburgh, as trustee. The debtor attributed his position to bad debts and losses on contracts. It was reported that the unsecured creditors included a loan creditor for £5,000 and a bank overdraft, after deduction of securities, £2,000. The Inland Revenue claimed £1,177, in respect of Excess Profits Duty. No offer was forthcoming, and it was decided to confirm the trust deed already executed.

Dissolution of Partnership.

LEICESTER & HOLT, electrical engineers, 60, Blackburn Road, and Sandcliffe Works, Haslingden.—Messrs. E. R. Leicester, P. H. Leicester, and H. Holt have dissolved partnership. Debts will be attended to by Messrs. P. H. Leicester and H. Holt.

New Belgian Companies.

Among the companies recently formed in Belgium are the following:—Arsenal Namurois d'Appareils pour Laboratoires Industriels et Scientifiques (Analis), Namur, capital 1,650,000 fr., to manufacture scientific and electrical instruments. Société Indépendante de Construction et d'Exploitation Radio Electriques, Machelen-lez-Brussels, capital 2,500,000 fr., to construct and exploit mechanical and electrical apparatus, particularly for telegraphy and telephony, with and without wires. Société Financière d'Electricité, Antwerp, capital 1,000,000 fr., to finance and operate central stations and gasworks, and to exploit all industrial and commercial applications of electricity and gas. "Lampe Union" N.V. Forest, capital 100,000 fr., to manufacture and deal in electric lamps, &c.

Lift Companies' "Alliance."

An "alliance" has been formed between Messrs. JOHN BENNIE, LTD., Glasgow, and Messrs. MARRYAT & SCOTT, LTD., E.C.1. Both are makers of lifts. The alliance will facilitate the production by Marryat & Scott of extra heavy machines, while the Scottish company will benefit in the matter of electrical and mechanical aid. The two businesses will be run as before, separately and in competition with one another. There will be an interchange of technical information.

Unemployment.

During the week ended August 22nd there was a rise of 22,250 in the number of unemployed. The total upon the date mentioned was 1,044,400, as compared with 1,022,150 on August 15th and 1,558,940 on August 23rd, 1926.

Mazda Lamp Campaign.

We have before us particulars of an enterprising advertising campaign which is being entered upon by the British Thomson-Houston Co., Ltd., of Crown House, Aldwych, London, W.C.2. The campaign is being conducted at a time when electrical dealers and traders are making their plans, laying in stocks, and generally preparing for a big lighting season. As we have all along stated, the benefits of the W. O. B. campaign are bound to continue long after the award of the prizes in the competition, and there is no doubt whatever that there will be a big demand during the coming months for electrical appliances and lamps in all districts, both as the outcome of that campaign and as a consequence of the Circle Campaign which is shortly to open. In order to reach as many old users of electric lighting as possible and those to whom its advantages have become available through the laying of additional mains during the past summer, the 1927-1928 Mazda Advertising Campaign has been planned on a very complete scale. One of its largest features will comprise the circulation by post of over a million 16-page booklets entitled "The Story of Mazda Lamps," and the trade should feel substantial effect from the time this huge post goes out early in the season to actual consumers. A second feature is a Mazda illuminated window display which occupies very little floor space in the window; it is a cut-out measuring 40 in. by 30 in. by 5 in. depth, featuring the Mazda girl pointing to an inscription on a blackboard. The wording is lighted from behind by means of a flashing lamp, while the words "Mazda Lamps" at the base of the display are continuously illuminated, also from the back of the display.

The display is provided with a thermal flasher, two lamp holders and an adaptor, ready wired to a length of flex for immediate use in the trader's window, the two lamps being the only items which the trader has to supply. Further, a number of new showcards are available. One takes the form of a cut-out (14½ in. wide by 17 in. high), depicting in pleasing colours the Mazda Girl, together with two small children carefully inspecting a gasfilled lamp. The second showcard is an oval one, made in very heavy cardboard, about ¼ in. in thickness, having a surface which gives the appearance of wood. The wording is embossed in gold lettering. This card is for displays of a special nature where coloured showcards might be unsuitable. There is also a quite small 3-piece cut-out, the three portions of which are attached to one another by threads, and when folded together can be placed in a small envelope. The cut-out consists of a Mazda lamp suspended below the title "Mazda Lamps," while the lower section bears a slogan. An automobile lamp showcard illustrates the Mazda Girl in outdoor garb, the picture forming a background for illustrations of Mazda auto-lamps and a table of types, sizes, and prices. On the back of the showcard are printed up-to-date particulars of the voltage and type of cap required for all passenger and commercial motor-cars and motor-cycles used in the United Kingdom. A new edition of the Mazda Lamp Catalogue of 36 pages has been issued, containing information respecting the wide range of Mazda lamps now available for all lighting purposes. Coloured lamps are illustrated in their natural tints. Many leaflets and folders have been produced in full colours, and are available for over-printing with resellers' names and addresses:—Leaflet L.406, giving particulars and prices of Mazda gasfilled and vacuum lamps, Pearl Mazda and Mazda colour-sprayed white and daylight lamps, all illustrated in their true natural colours, train lighting, tramway, steamship, traction and sign lamps. Folder L.405, containing complete details, prices and coloured illustrations of all types of Mazda lamps suitable for the home. Folder L.408, dealing exclusively with, and giving prices of, Pearl Mazda lamps. Folder L.407, giving details and prices of the complete range of Mazda automobile lamps.

Throughout the entire campaign the Mazda Girl with her happy and contented smile will be the central figure. Most of the publications are produced in full colours, orange and blue—the colours always associated with Mazda lamps—being predominant.

Traders are invited to co-operate by making the greatest possible use of the abundance of the above advertising material.

Falk, Stadelmann's Showroom Improvement.

Messrs. FALK, STADELMANN & Co., LTD., have recently redecorated and reorganised their Farringdon Road lighting fitting showrooms. The walls have been panelled in oak, relieved by a blue-grey colour scheme. A very wide range of fittings, mainly of the ceiling type, has been installed, and these are grouped in classes as far as possible. One section of the display is devoted to alabaster bowls, while painted glassware and opal glass are also given considerable space. A number of table and floor standards are exhibited, some of these being equipped with artistic vellum shades.

Book Notices.

"The Henley Telegraph," September, 1927 (48 pp., ill.). London: W. T. Henley's Telegraph Works Co., Ltd. Price 6d. net.—This bright little magazine is, as usual, of a very high standard, and a number of interesting and humorous notes and articles appear. We particularly like the "Suggestion Box" extracts.

"Harker's Engineer's Diary and Reference Handbook, 1928," pp. 48+C; illustrated. London: D. Harker & Co., Ltd. Price, leather bound, 3s.; renewable case, 4s.—In addition to the usual diary and memorandum pages, this book contains considerable engineering data, including electrical kW and h.p. conversion and wire gauge tables, compiled by Chas. H. Adams, A.M.I.Mech.E.

"Japanese Journal of Engineering Abstracts," Vol. 5. issued by the National Research Council of Japan.

"The Performance and Design of Direct-Current Machines," by A. E. Clayton, D.Sc. Pp. xii+418; figs. 261. London: Sir I. Pitman & Sons, Ltd. Price 16s. net.

"Overhead Electric Power Transmission Engineering," by W. T. Taylor. Pp. vii+532; figs. 71. London: Charles Griffin & Co., Ltd. Price 35s. net.

Engineers' Salaries at Burnley.

The Burnley Electricity Committee has received a letter from the Electrical Power Engineers' Association intimating that it is unable to accept the proposed revised salaries for the technical staff at Burnley, and intends to refer the matter to the District Joint Board for the Electricity Supply Industry.

Our Radio Exports.

The *Wireless Trader* reports that during July the value of radio apparatus exported from this country was £71,558 (including valves, £12,132), which was considerably below this year's monthly average. Australia was our principal customer, taking goods to the value of £22,031 (valves, £5,400), and the Netherlands was second with a share valued at £3,236 (valves, £1).

Australian Automatic Telephone Patents.

In the Australian Courts recently the Associated Telephone and Telegraph Co. (United States) applied for the extension, by 3½ years, of nine patents relating to automatic telephony, on account of loss incurred by reason of the war. Five of the patents were given a 2½-years' extension, but the applications in connection with the others were rejected.

For Sale.

Mr. G. R. Lightfoot will sell by auction on September 22nd and 23rd at 13, High Holborn, a large consignment of wireless sets and accessories. Under a deed of assignment Mr. C. H. Laycock has been instructed by the trustees and committee of inspection of the Gath Electrical Engineering Co., of 12, Horton Street, Halifax, to sell by auction on September 14th, the plant, electric motors, stock, &c. (See our advertisement pages to-day.)

The Marking of Imported Cables, Lamps, &c.

The Board of Trade has referred to the Standing Committee appointed under the Merchandise Marks Act, 1926, applications for Orders in Council to require the marking of imported insulated electric cables and wires; electric incandescent lamps; rubber manufactures (excluding tires and boots and shoes); and briar pipes and bowls. The Committee will consider whether the above goods should be marked on sale or exposure for sale, and it may, at its discretion, also consider whether the goods should be marked on importation. The dates of the Committee's public inquiries into these applications will be announced later, and any communications regarding them should be addressed to the secretary, Mr. E. W. Beardon, New Public Offices, Great George Street, S.W.1, as early as possible, and in any case not later than the end of September.

A "B. & W." Boiler Film.

Last week at the Hotel Cecil Messrs. Babcock & Wilcox, Ltd., invited representatives of the Press to view a film which they have produced for exhibition at the Shipping, Engineering and Machinery Exhibition, which is now being held at Olympia. The film was interesting and instructive. The first of the four reels, after depicting the primitive steam engine of Hero of Alexandria, showed the general arrangement of the Babcock & Wilcox boiler, indicating each main feature separately. After a short explanation the working of the boiler was represented—fire, air, gases and steam visibly doing their work. The second reel was devoted to the general manufacture of the boiler, including drum and nozzle construction. The forging and flanging of superheater boxes and the assembly of complete sections were seen in the third reel, while the last one showed the erection of boilers, including the building of a large model in a power house. The film takes three-quarters of an hour to display, and will be shown four times daily at the Exhibition, after which it will be available for private screening.

Vacuum Cleaner "Service."

An American firm of vacuum cleaner manufacturers has adopted the practice of issuing with each machine sold a "Perpetual Service Insurance Policy." In this the company undertakes that at any time after the expiry of the initial two-year guarantee period it will rebuild and recondition the machine at a cost not exceeding $10. Each time this service is rendered a one-year "rebuild guarantee" is given.

Gasfilled Lamp Price Reductions.

An announcement appeared in our last issue and an official memorandum has been received regarding the reduction of the prices of gasfilled lamps, as from September 1st, by members of the Electric Lamp Manufacturers' Association. The principal brands concerned are:—"Cosmos," "Cossor," "Cryselco," "Royal Ediswan," "Elasta," "F.-," "Mazda," "Neron," "Orion," "Osram," "Philips," "Siemens," "Stearn," "Stella," "Tungsram," and "Z." The types affected are clear glass, inside frosted, opal glass, daylight blue, sprayed and train-lighting. The reductions bring the prices to a little above the equivalent vacuum lamp prices, and should lead to a stimulation of sales. The following manufacturers have sent us separate lists announcing the reductions: The General Electric Co., Ltd. ("Osram" and "Pearl Osram"); Siemens Electric Lamps and Supplies, Ltd. ("Siemens," "Silvalux," and "Purlite"; Philips Lamps, Ltd. ("Philips" and "Argenta"); Pope's Electric Lamp Co., Ltd. ("Elasta"); the British Thomson-Houston Co., Ltd. ("Mazda"); Metro-Vick Supplies, Ltd. ("Cosmos"); the Edison Swan Electric Co., Ltd. ("Royal Ediswan"); Orion Lamps, Ltd. ("Orion"); and Tungsram Electric Lamp Works (Gt. Britain), Ltd. ("Tungsram" and "D").

American Capital for Japanese Electrical Industry.

Negotiations for the introduction of foreign capital into some Japanese electrical enterprises are said to be making steady progress. The Nippon Denryoku K.K. is to receive about 50,000,000 yen from a certain American firm, and the Shinyetsu Denryoku K.K. about 8,000,000 yen from another American firm. When these loans are concluded, some others will be negotiated.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances :—

	CHEMICALS, &c.	Price September 6th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3¼d. to 3½d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3¾d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£107 to £112	...
b	,, Wire ... ... per lb.	1/6 to 2/-	...
b	,, Sheet ... ... ,,	1/3 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—		
	Grade I ... ... per ton net.	£254	...
	Grade II ... ... ,, ,,	£175	...
	Grade III ... ... ,, ,,	£89	...
c	Brass (rolled metal 2" to 12" basis) per lb.	9¾d.	...
c	,, Tubes (solid drawn) ... ... ,,	11¼d. to 11¾d.	...
c	,, Wire, basis ... ... ,,	9¾d.	...
c	Copper Tubes (solid drawn) ... ,,	1/0½	...
c	,, Bars (best selected) ... per ton.	£86	...
c	,, Sheet ... ... ,,	£86	...
c	,, Rod ... ... ,,	£86	...
d	,, (Electrolytic) Bars ... ,,	£62 10s.	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£72 10s.	...
d	,, ,, H.C. Wire per lb.	9½d.	...
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	8/-	...
h	India rubber, Para fine ... ... ,,	1/4½	½d. inc.
l	Iron Pig (Cleveland No. 3.) ... per ton.	75/-	...
l	,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g	Lead, English pig ... ... ,,	£23 10s.	15s. dec.
g	Mercury ... ... per bot.	£21 15s. to £22	...
e	Mica (in original cases) small ... per lb.	3d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up.	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/3	...
p	,, ,, rolled strip & sheet ,,	1/2½	...
p	,, ,, wire... ... ... ,,	1/3½	...
o	Platinum ... ... per oz.	£14 10s.	...
d	Silicium Bronze Wire ... ... per lb.	10½d.	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
n	Tin, Block (English) ... ... per ton.	£287 10s. to £288 10s.	25s. inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on September 3rd, Messrs. James Forster & Co. stated that there was little of interest in the general lead position. "Consumers are apathetic, and take little interest in the market, buying only for immediate wants, leaving the future to take care of itself on the certain knowledge that there are ample supplies available. Imports for August, according to Customs Entry Bill A, are about 23,000 tons. A drastic cut in production by the closing of expensive working mines seems to be the only possible road to better conditions, but we shall be surprised if Australia shows the way in this! The men there have too much at stake to refuse to meet owners on the question of longer hours after the heavy reduction of values in the last few months."

Lighting and Power Notes.

Argentina.—ELECTRICAL DEVELOPMENT.—According to the *Review of the River Plate*, a Government decree has been recently issued, authorising the Italo-Argentine Electricity Co. to take possession of a piece of ground, measuring 90,000 square metres, in the vicinity of the New Port, for the construction of a large power station. The decree specifies all the conditions under which the concession is granted, including the laying out of a system of docks and wharves to facilitate the handling of fuel. The Italo-Argentine Co. has already prepared plans for the new plant, which will be initiated as soon as the preliminaries regarding the concession are carried out. It is proposed to spend some $50,000,000 paper upon the scheme.

Australia.—COLLIE (N.S.W.).—According to the *Electrical Engineer of Australia and New Zealand*, the Collie power scheme, which was to be established for supplying electricity in the south-western portion of Western Australia, appears to be held up. A Bill was passed through Parliament, providing for the establishment of a trust to administer the undertaking, but no further steps have been taken. The scheme was to be financed by the municipalities of Collie and Bunbury raising half the capital and the Government providing the other half. The power station was to be established at Collie and energy transmitted to Bunbury. It is now stated that in the preliminary estimates no provision was made for the transmission line from Collie to Bunbury, and certain other factors were not taken into consideration. In addition, Bunbury already has an electric supply undertaking, and does not see that any advantage will accrue through taking a supply from Collie. Collie also has a supply undertaking, and although it could doubtless be improved, there is no warrant for embarking on a large capital expenditure for purely local purposes. So the project has been postponed indefinitely.

BENDIGO. — The *Melbourne Argus* reports that the Bendigo City Council, at a recent meeting, decided to reject the offer of the Electric Supply Co. of Victoria, Ltd., for an extension of the franchise for 30 years of the electricity and tramway services of the city. The present agreement with the company expires in 1931, and it is the intention of the Council to confer with the Electricity Commission for the linking up of Bendigo with the State scheme. The Mayor said that it was imperative that Bendigo should take the lead in obtaining electricity from the Yallourn scheme in order that the surrounding districts in northern Victoria could participate in the State enterprise.

Blackpool.—TRANSMISSION LINE.—Preliminary tests of the new Preston-Blackpool line are expected to take place on September 24th in good time for the Blackpool illuminations. All the poles have been erected, and most of the supporting arms have been put into position, while the conductors have been installed for several miles.

Burnley.—YEAR'S WORKING.—The report of the borough electrical engineer (Mr. J. E. Starkie) on the working of the Corporation electricity undertaking for the year ended March 31st last shows a total revenue of £91,962, as compared with £90,432 in the preceding year. The coal dispute was responsible for an increase in working expenses from £48,288 to £72,872, and the gross profit was therefore £19,090, as against £42,144. Capital charges absorbed the whole of the gross surplus, and there was a net loss of £6,062, as compared with a surplus of £15,829 in the preceding year. The capital expenditure during the year amounted to £18,903, and the total now expended on the undertaking stands at £409,092. The electrical energy sold increased from 9,673,843 to 10,592,835 kWh. The average price obtained per kWh fell from 2.186d. to 2.006d.

Cheltenham.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. W. J. Bache) for the year ended March 31st last show a total revenue of £62,092, and working expenses amounting to £47,266, leaving a gross profit of £14,826. After payment of capital charges there was a net deficit of £2,121. The sales of electrical energy increased from 4,644,906 to 5,326,434 kWh. The maximum supply demanded reached 3,370 kVA.

Continental.—FRANCE.—Owing to financial reasons, there has been some delay in establishing the hydro-electric station which the Société des Forces Motrices de la Truyère is erecting to utilise the water power of the Brommat falls on the River La Truyère. The initial plant is to be of 100,000 h.p., but this may eventually be increased to 200,000 h.p. It is reported that a syndicate of French electrical concerns is now arranging to find the necessary money to enable the work to be proceeded with more rapidly.

GERMANY.—The new Klingenberg electric power station, which has recently been put in operation at Rummelsburg, Berlin, by the Berlin Municipal Electricity Co., has an initial capacity of over 300,000 kVA, the plant now in operation comprising three main turbo-generators, each of 88,000-kVA capacity, and three feed-water heating sets of 12,500 kVA, generating electricity at 6,000 V. The necessary steam is raised by a battery of 16 boilers, each having a heating surface of 18,837 sq. ft. The boilers, which are all fired by pulverised fuel, work at a pressure of 35 atmospheres and generate steam at a temperature of 425 deg. C.

Derbyshire.—HOPE VALLEY DEVELOPMENTS.—Messrs. Earle, the Hull cement manufacturers, propose to open up large works in the Hope Valley, near Sheffield, and in connection therewith they will generate about 30 million kWh of electricity per annum. An electricity supply is to be made available to residents in the district.

Frizington.—OPPOSITION TO SCHEME.—The Urban District Council has decided to oppose an application by the Old Silkstone Collieries, Ltd., for a Special Order to supply electricity in the Council's area. The proposed scheme includes a generating station at the works of the Allerdale Coal Co., and the Council's decision is on the grounds that the distance from the generating station would mean that it would be many years before electricity could be supplied to the town, and that the scheme would seriously affect the Council's gasworks.

Ipswich.—ELECTRICITY IN BULK.—The Corporation Electricity Committee has obtained the sanction of the East Suffolk County Council to lay the necessary mains in connection

with the proposed bulk supply of electricity to Woodbridge and Melton.

Japan.—ELECTRICAL DEVELOPMENT.—The Government Railway Department is to erect a power station at Kawasake, the plant for which will include three 20,000-kW turbo-generators.

Kingussie.—ELECTRICITY AGREEMENT.—The agreement with the Grampian Electricity Supply Co. for the supply of electricity to the burgh was confirmed at a recent meeting of the Town Council.

King's Lynn.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer: Mr. C. W. Jackson) for the year ended March 31st last records a total income of £24,602, and working expenditure of £15,907, leaving a gross profit of £8,754. The figures for the preceding year were:—Income, £19,366; working expenses, £11,045; gross profit, £8,320. After providing for capital charges, there was a net surplus of £2,474, as compared with £3,105 in the previous year. The capital expenditure during the year amounted to £15,524, and the total now expended on the undertaking stands at £150,762. The electrical energy sold increased from 1,535,926 to 1,919,258 kWh, and the average price obtained per kWh fell from 2.82d. to 2.80d.

Maidstone.—YEAR'S WORKING.—We have received from Mr. E. E. Hoadley, engineer and manager of the Corporation electricity undertaking, a copy of his report, together with the statement of accounts, for the year ended March 31st last. The total revenue amounted to £123,168, as compared with £94,912 in the preceding year. The increased cost of fuel as a result of the coal dispute was largely responsible for the higher working costs, which were £81,562, as against £62,673. The gross profits was therefore £41,606 (£32,239), and after meeting capital charges there was a net surplus of £17,305, as compared with £10,764 in 1925-26. The capital expenditure during the year amounted to £32,799, the chief item being £18,427 for mains. The sales of electrical energy increased from 16,605,027 to 19,735,472 kWh. and the maximum supply demanded from 5,600 to 6,520 kW. The average price obtained per kWh increased from 1.32d. to 1.43d.

New Zealand.—AUCKLAND.—The *Electrical Engineer for Australia and New Zealand* states that the report of the general manager of the Auckland Power Board, Mr. R. H. Bartley, for the year ended March 31st, 1927, reveals a very considerable increase in the energy sold for domestic purposes. During the year 1925-26 the electricity sold for domestic supply totalled 6,880,785 kWh, but for 1926-27 the total was 19,138,847 kWh. This increase is largely accounted for by the numbers of cooking stoves and water heaters that are being sold. During the last year, 1,216 stoves and 2,218 water heaters were connected, and since the beginning of the current year about 30 stoves and 40 heaters per week have been connected. The average price per kWh sold for domestic supply last year was 1.57d.

North Berwick.—CHANGE-OVER.—Notice is given that the Corporation intends to apply for consent to alter the system and pressure for electricity supply from d.c. at 240 V to a.c. 50 cycles at 230 and 400 V.

Oxford.—ELECTRICITY SUPPLY.—The Oxford Electric Co., Ltd., has written to the City Council stating that if the Council agrees to a suspension of its powers to purchase the undertaking it is prepared to put into effect a flat rate of 5½d. per kWh for electricity.

Rochdale.—ALL-ELECTRIC HOUSES.—The Corporation has approved a recommendation of the Housing Committee to erect 192 all-electric houses at Castleton.

Scunthorpe.—ASSISTED WIRING SCHEME REJECTED.—The Urban District Council has rejected a proposal by the Electricity Committee to inaugurate an assisted wiring scheme, for which a loan of £658 to cover the cost of wiring 100 houses would be required.

Seaham Harbour.—INAUGURATION OF SUPPLY.—The Urban District Council's electricity undertaking was recently formally inaugurated by the chairman of the Lighting Committee. This comprises three sub-stations, receiving electricity bought from the County of Durham Electrical Power Distribution Co. and taken from its Cold Hesledon sub-station at 6,000 V. Electricity is transformed at the three sub-stations to 440 V, three-phase, for power, and 250 V, single-phase, for lighting, and is distributed by means of overhead lines. Many private consumers are being connected, and about 800 street lamps lighted electrically. The cost of the scheme has been about £20,000. The contractors included Messrs. Gray Bros. (Newcastle), Ltd., for the overhead line and sub-station plant; Messrs. Reid, Ferens & Co., for the underground h.p. cable laying; and Messrs. Reyrolle & Co., Ltd., for the ironclad switchgear.

Stirling.—ELECTRICITY IN BULK.—The Electricity Commissioners have given sanction to the Corporation entering into a contract with the Scottish Central Electric Power Co. for a bulk supply of electricity.

Stone.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Urban District Council to supply electricity in the urban district and part of the rural district.

Swansea.—PRICE REDUCTIONS.—The Electricity Committee has approved the following reductions in the charges for electricity as from January 1st next:—Lighting: Flat rate from 5½d. to 5d. per kWh. Maximum demand system: From 20 per cent. to 10 per cent. Heating and cooking: A reduction of ½d. per kWh for the winter quarters, making the charge 1d. per kWh both winter and summer. Power: The war increase of 12½ per cent. to be removed.

Tamworth.—SPECIAL ORDER.—The Electricity Commissioners have decided to grant the application of the Pooley Hall Colliery Co., Ltd., for the Polesworth and District Electricity Special Order in respect of the whole of the area applied for, subject to the insertion of a provision requiring the undertaking to be transferred within a limited period to a separate company. The application of the Leicestershire and Warwickshire Electric Power Co. for the Market Bosworth and District Electricity Special Order, in so far as it relates to the area applied for by the Pooley Hall Co., has been rejected. Provision is made in the Order for the revocation of the Atherstone and District Electricity Special Order, 1922, in so far as it relates to the area included in the Polesworth Order.

Tynemouth.—ELECTRICITY EXTENSIONS.—The Electricity Committee has received a report from the electrical engineer upon the need for further extensions in the near future, and has decided to apply for sanction to a loan of £15,000 for mains and services.

LOAN SANCTIONED.—The Committee has received sanction to a loan of £25,460 for electricity purposes.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to *Power*, a 50-year licence for a power project on the Saluda River in South Carolina, which will have an ultimate development of 260,000 h.p., installed capacity, was granted to the Lexington Water Power Co., of Columbia, S.C., by the Federal Power Commission on August 5th. The project will be at Dreher's Shoals, and will extend into the counties of Lexington, Richland, and Newbury. It will consist of a dam, with fill, of about 8,000 ft. crest line, and a cut-off embankment 1,000 ft. long, the crest elevations of each to be 372 ft.; a reservoir with an area of 76 sq. miles; six penstocks, and a power house with six 32,500-kW sets under a 183-ft. head.

Venezuela.—HYDRO-ELECTRIC DEVELOPMENT.—A hydro-electric plant has been installed in the town of Zea, in the district of Tovar, and another is being constructed in Ocumare-de-la-Costa, where an aqueduct is also being built.—*Reuter's Trade Service* (Caracas).

Wrexham.—REVISION OF CHARGES.—The Town Council has made the following new scale of charges for electricity as from October 1st next:—General lighting: Flat rate of 6d. per kWh up to 1,000 kWh per quarter; 1,000 to 2,000, 5d. per kWh, beyond, 2½d. per kWh, less 5 per cent. for prompt payment of accounts. Lighting, heating, and other domestic purposes: 20 per cent. on the rateable value, plus 1d. per kWh, less a discount of 5 per cent. Lighting in shops and other business premises using over 250 kWh per summer quarter, and over 500 each winter quarter, fixed rentals of 2s. 6d. per summer quarter and 6s. per winter quarter for each 100-watt lamp, and 2½d. per kWh, less 5 per cent. Slot meters: 8d. per kWh. Heating and cooking: 1½d. per kWh, less 5 per cent. Power: Premises not consuming more than 1,000 units per quarter, 3d. for the first 500 kWh, and 2½d. beyond, less 5 per cent.; premises using over 1,000 kWh per quarter, 2½d. for the first 1,000 kWh, and 2d. beyond, less 5 per cent.

Tramway and Railway Notes.

Continental.—FRANCE.—The work of converting the steam tramway between St. Servan, St. Malo, and Paramé, Brittany, to electric traction has recently been completed.

GERMANY.—In connection with the electrification of the railways in Silesia and Saxony, the German State Railway Co. has given orders for over 80 electric locomotives and other rolling stock to an estimated value of £1,700,000.

As a result of various applications for the introduction of electrical working on the railways, the managers of the Reich railways point out that the conversion of the entire German network from steam to electric traction would necessitate an outlay of £500,000,000. In the circumstances the work can only be carried out gradually, and in this respect a plan is being systematically followed of first transforming to electrical working those sections which have steep gradients and are costly in working by steam power. For this reason work is now proceeding on the Munich-Ulm-Stuttgart line and the line between Munich and Salzburg.

After the completion of this work and the Berlin suburban lines, it is stated that the network in the district of the Ruhr will possibly be taken in hand.

SPAIN.—The Oerlikon Company has recently received a contract for the complete electrical equipment of all the substations of a Spanish railway, the Ferrocarriles Vascongados, connecting San Sebastian with Bilbao, on which h.p., d.c., is being adopted as the traction system. The substations are fed with 3-phase current at 29,000 V, 50 cycles, which is converted into d.c. by rotary convertors. The convertors are designed for a continuous output of 1,200 kW and for a terminal pressure of 17,500 V on the d.c. side.

Ilford.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking (manager: Mr. L. E. Harvey) for the year ended March 31st last record a total income of £72,208, and working expenditure of £57,190, leaving a gross profit of £72,208. The figures for the preceding year were:—Income, £69,821; working expenses, £56,365; gross profit, £13,456. To the gross profit was added revenue from other sources amounting to £2,219, making a total of £17,236 available. After payment of capital charges there was a net surplus of £4,921, as compared with £2,446 in the preceding year. The number of passengers carried increased from 14,169,251 to 14,647,003, but the car-miles run fell from 1,014,854 to 999,650. The average traffic revenue per car-mile increased from 16.393d. to 17.216d.

Keighley.—YEAR'S WORKING.—The annual report of the Corporation tramway undertaking shows a loss on the year, with regard to the railless cars, of £3,191, but a profit on the motor-omnibuses of £2,326. The profit on the motor-'buses has been transferred to the motor-'bus reserve fund, and from this fund a sum of £1,549, together with a sum of £1,642 from the borough rate has been transferred to the railless-car account to meet the deficit. In addition, a sum of £2,182 has been transferred from the borough rate to the tramway account in connection with the tramway, which was scrapped three years ago, but for which annual payments will have to be made until 1930. The railless-car account shows a total revenue of £18,693 (15.065d. per car-mile) and total working expenses of £16,119 (12.990d. per car-mile).

New Zealand.—AUCKLAND.—The accounts of the Corporation tramway undertaking (manager: Mr. A. E. Ford) for the year ended March 31st last shows a total revenue of £637,782, as compared with £593,092 in the previous year. Working expenses amounted to £519,707, as against £479,420, leaving a gross profit of £118,075 (£113,672). After deducting capital and other charges there was a net surplus of £9,006. There was, however, a loss of £48,124 on the motor-omnibus service, and thus the net result was a loss of £39,118, as compared with a deficit of £28,292 in the preceding year. The capital expenditure during the year included £64,392 for permanent-way, £40,052 for buildings and fixtures, £32,274 for motor-omnibuses, and £24,892 for electric cars. The number of passengers carried increased from 55,881,719 to 56,781,195, and the car-miles run from 5,817,059 to 5,962,199.

Telegraph and Telephone Notes.

Belgium.—TELEPHONE SERVICE.—As a result of the recent completion of the laying of underground telephone cables Brussels is now in telephonic communication with Berlin, Frankfort-on-Main, Hamburg, and Vienna. Antwerp is also now connected up with Berlin and Hamburg.

Brazil.—TELEPHONE SERVICE.—The Brazilian Telephone Company has now established interurban communication between most of the important cities and towns in the States of Rio de Janeiro, Sao Paulo, and South of Minas.

Channel Islands.—TELEPHONE DEVELOPMENT.—The telephone service of Jersey, one of the Channel Islands, has nearly doubled the number of its subscribers since 1923, when the system was purchased from the British Post Office for £32,000. There were then only 1,600 subscribers; to-day, as the result of a progressive business policy, there are 3,000, an increase of 1,400 subscribers. Jersey, therefore, has now six telephones to each 100 of population. The neighbouring island of Guernsey, which has run its own telephones since 1898, shows a proportion of 9½ telephones to each 100 inhabitants.

France.—TELEPHONE SERVICE.—Considerable improvement has recently taken place and is at present in progress in connection with telephonic communication between France and foreign countries. The recent inauguration of telephone cables between Selestat and Basle and between Strasburg and Appenweier marks the completion of the underground system connecting Paris with eastern France and with European central and eastern countries. The Paris-Nancy underground cable, with an extension *via* Strasburg and Mulhouse, has also been linked up with the German underground system and with the Swiss system, with the result that Paris can now be quickly connected up to Luxemburg, the Saar district of Germany, and with Italy. New connections are also being made which will permit communication between Paris and Hamburg, Vienna, Prague, Barcelona, and Madrid. Negotiations are also now in progress with regard to connections with Denmark, Sweden, and Hungary.

India.—"BEAM" SERVICE.—The Anglo-Indian Beam Wireless Service was opened for public traffic on September 6th. The new service places London in direct wireless communication with Bombay, and will be available for telegrams to all destinations in India, Burma, Ceylon, Iraq, Persian Gulf, Siam, &c. The reduced rates per word to India by this route are 1s. 1d. for ordinary telegrams, 6½d. for deferred telegrams, 3½d. (with a minimum of 20 words) for daily letter telegrams, and 3d. (with a minimum of 20 words) for week-end letter telegrams. Messages for transmission by the new beam service may be handed in at any postal telegraph office, and should be marked with the free routing instruction, "*via* Empiradio." Full particulars of the service can be obtained on application at any postal telegraph office. In addition to the reduction in the rates for public traffic the beam service offers a reduced rate of 2½d. a word for Press messages.

WIRELESS IN MINES.—Mr. Keith Murray, of the Calcutta Broadcasting Station, proposes to carry out extensive tests for the purpose of gathering data, in order to gauge the possibilities of intercommunication in coal mines by means of wireless. The present method of communication is by means of the telephone, which has serious drawbacks. It is stated that the experiments will commence about the end of September; the information obtained therefrom will be sifted and alterations will be effected in transmitters and receivers before a further attempt is made. The wave-length used will be 30 metres, and another wave will be between 1 and 6 metres; the latter seems to have been specially licensed by the Government.

South Africa.—"BEAM" WIRELESS SERVICE.—The Postmaster-General announces that a week-end letter telegram service to the Union of South Africa has been introduced by the Anglo-South African beam wireless service at the reduced rate of 3½d. a word, with a minimum of 5s. 10d. for a message not exceeding 20 words. Telegrams for the new service can be handed in at any postal telegraph office.

The Telephone Service.—NORTH-EAST COAST.—The Post Office has in hand schemes for installing the automatic telephone system in all the big centres on the North-East Coast. Installations have already been carried out at West Hartlepool and Darlington, and work is proceeding on a much bigger scheme at Newcastle and Tyneside, whilst a start will shortly be made at Sunderland, Stockton, and Middlesbrough. The Sunderland installation is estimated to cost nearly £250,000. The building of a central and five sub-exchanges will cost £150,000, equipment £121,000, and laying of underground cables £20,000.

Radio Notes.

Canada.—RADIO DEVELOPMENT.—A *Reuter* message from Ottawa states that every thirtieth Canadian owns a wireless receiving set, according to official figures. There are 55 broadcasting stations in the Dominion, and, in addition, the Government has established a chain of 48 coastal and lake transmitting stations as aids to navigation on the Pacific and Atlantic Oceans and the Great Lakes.

Denmark.—NEW STATION.—The new wireless station built by the Government near Kallundborg in the north-west of Zeeland, was opened on August 29th by M. Stensballe, the Minister for Public Works, and M. Chambellan Lerche, the President of the Wireless Council. The station works on an output of 7 kW, and will broadcast daily on a 1,153 metres wave length.—*Reuter* (Copenhagen).

Empire Broadcasting.—PROGRAMME FROM AUSTRALIA.—The first attempt to broadcast to the Empire from Australia was made on September 4th, from the Sydney station 2FC. The programme was received by the B.C.C. at the Keston station and relayed to all stations with excellent results.

Licences.—The latest figures available show that there were 2,306,285 broadcasting licences in force at the end of July, in addition to 8,150 issued free to blind listeners. This is an advance of over 7,000 on the previous month's total. The number of licence-holders has increased by 71,000 in six months, in spite of the summer season. An interesting feature of the latest figures is the increasing extent to which blind persons are availing themselves of the privilege of free licences. At the end of January only about 2,000 had received them.

Russia.—BROADCASTING STATIONS.—According to a note published by the *British Russian Gazette and Trade Outlook*, there are now 56 broadcasting stations in Russia, of which nine are in Moscow and five in Leningrad.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Aberdeen.—September 23rd. The Northern Co-operative Society, Ltd. Supply of machinery and equipment in connection with the construction of dairy. Specifications, &c., from the engineers, Messrs. Tawse & Allan, 10, Bon Accord Square; offers to Mr. John Ferrier, managing secretary, 54, Loch Street.

Australia.—NEWCASTLE.—October 17th. Electricity Department. Outdoor switchgear and protective relays. (B.X. 3771.)*

MELBOURNE.—October 25th. Plugs, switchboards, and instrument types. (B.X. 3780.)* Automatic telephone switchboard equipment for Hobart. (B.X. 3782.)*

Belgium.—ST. GILLES, BRUSSELS.—September 20th. Municipal Council. Supply of 150 3-amp., 600 5-amp., and 100 10-amp. ampere-hour meters, and five 20-amp. watt-hour meters, all for 220-V circuits. Particulars (Cahier des Charges) for 5 fr. from Service de l'Electricité, 40, Rue de Bethléem, St. Gilles, Brussels.

SCHAERBEEK.—September 14th. Municipal Council. Supply of 4,500 metres of l.p. cable and equipment of a static transformer cabin. Particulars (Cahier des Charges) for 10 fr. from Service de l'Electricité, Hotel Communale, Place Colignon, Schaerbeek.

Belfast.—October 1st. Electricity Committee. Steam, water, and other piping. (See this issue.)

Birmingham.—September 10th. Board of Guardians. Installation of electric heating at the Union Offices, Edmund Street.

Blackpool.—Electricity Department. E.h.p., h.p., and l.p. P.I.L.C. armoured cables for 12 months, house service boxes and cutouts. (See this issue.)

Bury. — October 12th. Electricity Department. Two water-tube boilers, with superheaters, economisers, mechanical stokers, coal and ash-handling plants. (See this issue.)

Bolsover.—Urban District Council. Wiring houses in the Council's district. (See this issue.)

Bulgaria. — PLOVDIV. — September 12th. Town Council. Supply of materials for and erection of a power station.—*Reuter's Trade Service* (Sofia).

Dublin.—October 1st. Electricity Department. Transformers for 12 months. (See this issue.)

September 17th. Single-phase and three-phase meters. (September 2nd.)

Dundee. — September 16th. Electricity Department. Supply and delivery of d.c. and a.c. house service meters. (September 2nd.)

Eccles (Lancs.). — September 12th. Town Council. Electric lighting installation, 78 houses, Gaskell Road. September 14th. Electric lighting installation at the mains stores, King Street. Borough Electrical Engineer, Cawdor Street, Patricroft.

Edinburgh.—September 17th. Tramways Department. Supply of 1,200 tons of steel tramway rails. Specifications, &c., from Tramway Manager.

Egypt.—CAIRO.—October 1st. State Railways, Telegraphs and Telephones. Supply of underground cables, from £E6,000 to £E6,300. Firms should communicate direct with the Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, S.W.1.—*Reuter's Trade Service* (Cairo).

October 26th. Ministry of Public Works. 7,500-kW thermal power station for Belgas. (B.X. 3748.)*

Glasgow.—September 12th. Corporation. Electric lighting installation in connection with the new halls at Bridgeton. Specifications, &c., from Office of Public Works, 64, Cochrane Street.

Grimsby.—September 20th. One 500-kW convertor, transformer, l.p. switchgear, cable work, &c. (August 26th.)

Hatfield-with-Stainforth (Yorkshire). — Education Department. Installation of electric light at Dinscroft new school. Particulars from Education Department, County Hall, Wakefield.

Heston and Isleworth.—September 19th. Electricity Department. Two 1,000 kW motor convertors, transformer, and switchgear. (September 2nd.)

India.—September 16th. India Store Department. September 13th. Two 30-kW oil engine d.c. generating sets, complete with cables and accessories. (August 26th.)

September 23rd. 26,913 inert cells.

September 27th. 262 miles electric cable, D.2 and D.3. (See this issue.)

September 23rd. Bombay, Baroda, and Central India Railway Co. Motors and starting pillars. (See this issue.)

Kirkcaldy.—September 24th. Town Council. E.h.p. switchgear, transformers, and equipment for static substations. (September 2nd.)

London.—ST. MARYLEBONE.—September 19th. Board of Guardians. Installation of electric cables, &c., at the Hospital. (September 2nd.)

Luxemburg.—September 19th. Following the recent decision of the Chamber of Deputies, the Government of the Grand Duchy of Luxemburg is inviting fresh offers for the establishment and working of an electricity distribution system throughout the country. Tenders are to be sent to the Directeur-Général des Travaux Publics, Luxemburg. Particulars (Cahier des Charges) can be obtained for 75 francs from the Bureau d'Etudes et de Construction pour l'Electrification du Grand Duché de Luxemburg, 3, Avenue de la Liberté, Luxemburg.

New Zealand.—WELLINGTON.—October 11th. Public Works Stores Department. Supply and delivery of 1,000—50,000-V insulators. (B.X. 3742.)*

November 29th. Two sets of transformer-oil drying and testing sets for the Waikaremoana scheme. (A.X. 5175.)*

October 27th. Wellington Hospital Board. Electrical and oil fuel equipment. (B.X. 3781.)*

Oldham.—September 12th. Board of Guardians. Electric lamps and fittings. Particulars from F. W. Fletcher, clerk to Guardians, Union Offices.

Pontypridd.—September 12th. Urban District Council. One 500-kW rotary convertor, transformer, and necessary switchgear. (August 26th.)

Seacroft (near Leeds).—Installation of electric light at Seacroft Chapel and schools. Particulars from Mr. Arthur Flowith, Austhorpe Road, Grossgates, near Leeds.

South Africa.—DURBAN.—September 23rd. Municipal Council. Eight 500-kVA single-phase transformers for Scott connection. Two 300-kVA, 3-phase transformers. Twenty 100-kVA, single-phase transformers.

September 30th. Four e.h.p. switch-panels.

October 14th. Six e.h.p. switch-cubicles.

CAPE TOWN.—September 21st. Town Council. Supply and delivery at the Dock Road power station stores of electric light poles, cross arms, insulators, binding wire, &c. Particulars from the city electrical engineer.

September 21st. Electricity Department. Cables. (B.X. 3751.)*

October 19th. Electricity Department. Supply and delivery of one direct-coupled motor-driven centrifugal pump. (A.X. 5157.)*

JOHANNESBURG.—September 26th. Municipal Council. Street lighting material. (B.X. 3752.)*

October 6th. South African Railways and Harbours. 200-V switchboard for the Durban workshops. (B.X. 3739.)*

October 20th. 265 perforated spark-arrestor mild steel plates (8×4×¼). (A. 5169.)*

October 20th. Suction gas engine and electric generator. (B.X. 3772.)*

PRETORIA.—Union Tender Board. December 1st. Manual telephone exchanges for East London and Kimberley.

Southend-on-Sea.—October 3rd. Light Railways and Electric Lighting Department. Fuse boxes and troughs. (See this issue.)

Stafford. — September 26th. Staffordshire Education Committee. Installation of electric light and power, King Edward VI School. (September 2nd.)

Stourbridge.—September 13th. Stourbridge and District Water Board. Pumping machinery, including a 5-kW, d.c. dynamo, 220 V, with switchboard and fittings. Particulars from G. Plant Deeley, consulting engineer, 13, Church Street, Stourbridge.

Stockport.—September 19th. Electricity Committee. One 20,000-kW turbo-alternator and surface condensing plant. (August 26th.)

Swindon.—September 10th. Corporation. Three 2,000-kW and two 500-kW rotary convertors with transformers; and six static transformers of from 500 to 2,000-kVA capacity. (August 26th.)

Warrington.—September 20th. Board of Guardians. Six months' supply of electrical sundries. The Clerk, Museum Street, Warrington.

Wigan.—September 12th. Board of Guardians. Six months' supply of electrical sundries. The Clerk, King Street, Wigan.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bolton.—Electricity Committee. Accepted:—
Two electrically-operated ash hoists at generating station.—Wadsworth, Ltd.
Extension of ash rail track.—John Booth & Sons, Ltd.

Lamp Contracts.—The Edison Swan Electric Co., Ltd., Metro-Vick Supplies, Ltd., the British Thomson-Houston Co., Ltd., and Siemens Electric Lamps & Supplies, Ltd., have received 12-month contracts for the supply of lamps from the General Post Office. The last company has also received a 6-month lamp contract from the Southern Railway Co.

Leeds.—Tramways Committee. Accepted:—
1,500-kW rotary convertor and equipment for Crown Point power station (£6,406). Switchgear (£4,906).—Metropolitan-Vickers Electrical Co., Ltd.
6,000 rail clips and screws (£150).—Bayliss, Jones and Bayliss, Ltd.
Electricity Committee. Accepted:—
Cables (£281), W. T. Henley's Telegraph Works Co., Ltd.; (£2,900), Macintosh Cable Co., Ltd.; (£1,437), Enfield Cable Works, Ltd.; (£891), Hackbridge Cable Co., Ltd.; and (£786), Greenwich Cable Works, Ltd.

London.—METROPOLITAN ASYLUMS BOARD.—Works Committee.
Re-wiring part of fire-alarm system at Darenth training colony:—

L. G. Tate & Co., Ltd. (Recommended.)	**£118**
Toy & Winslow	203

Installation of telephone, fire-alarm, and call-bell systems at Southern Hospital:—

Alpha Manufacturing & Electrical Co., Ltd. (Accepted.)	**£1,835**
T. Clarke & Co., Ltd.	1,885
Read & Partners, Ltd.	2,004
G. E. Taylor & Co.	2,075
Electrical Contracts & Maintenance Co. (1925), Ltd.	2,561

BERMONDSEY.—Electricity Committee. Rotary convertor, transformer, switchgear cables, &c., for new sub-station:—

Electric Construction Co., Ltd. (Recommended.)	**£4,340**
English Electric Co., Ltd.	4 913
Mather & Platt, Ltd.	5.019
Metropolitan-Vickers Electrical Co., Ltd. ...	5.055
General Electric Co., Ltd.	5.096
Bruce Peebles & Co., Ltd.	5,290
Hewittic Electric Co., Ltd. (rectifiers and transformer)	6,609

WAR OFFICE. Accepted:—
Inert cells.—Edison Swan Electric Co., Ltd.

Malmesbury (Wilts.).—
Electric lighting installation at Malmesbury Abbey (£197).—Edwards & Armstrong Ltd.

Manchester.—Tramways Committee. Accepted:—
Special track work.—Edgar Allen & Co., Ltd., Hadfields, Ltd., and the Titan Trackwork Co., Ltd.
Block tin.—Williams, Harvey & Co., Ltd.
Under-carriages for permanent-way trailers.—W. E. Cary, Ltd.
Watch Committee. Accepted:—
Electric lighting installation at Goulden Street police station.—R. H. Clampnett & Co.
Central Purchasing Committee. The following revised tenders for incandescent electric lamps have now been accepted:—
Drake & Gorham, Ltd.; F. G. Ride & Co., Ltd.; Sloan Electrical Co., Ltd.; Baxendale & Co., Ltd.; S. Gratrix, Junior & Brother, Ltd.; Berry's Electric, Ltd.; Underwood (Manchester), Ltd.; J. C. White; Electric Lamp Supplies, Ltd.; R. O. Brien & Co.; W. E. Beardsall & Co., Ltd.; Wholesale Fittings, Ltd.; J. Russell & Co., Ltd.; Downes & Davies, and Nelson Electric Company, Ltd.—all of Manchester; and Kye, Ltd., of London.

Northampton.—Finance Committee. Recommended:—
Installation of electric lamps and fittings and ventilating fans at the Lower Assembly Rooms (£175).—Northampton Electric Light & Power Co., Ltd.

Plymouth.—Mental Hospital Committee. Accepted:—
56/70-h.p. Parsons standard stationary engine, with dynamo by the Electric Construction Co. (£477).—Parsons Oil Engine Co., Ltd.
Electricity Committee. Accepted:—
Supply and erection of a transporter beam at Prince Rock works (£224).—Fraser & Chalmers Engineering Works.

Salford.—Health Committee. Accepted:—
Wiring premises in Regent Road (£102).—John Armstrong and Co. (Manchester), Ltd.

South Queensferry.—Town Council. Accepted:—
Laying supply cables, &c., in connection with electric lighting scheme.—Laurie & Co. (Falkirk).

Welshpool.—Town Council. Accepted:—
Wiring the town hall for electric lighting (£269).—Messrs. Thomasson.

Forthcoming Events.

Shipping, Engineering, and Machinery Exhibition.—September 8th to 24th. At Olympia, W.

Institution of Public Lighting Engineers.—September 12th to 15th. Brighton Annual Conference.

Institute of Marine Engineers.—Tuesday, September 13th. The Institute, The Minories. 6.30 p.m. Presidential address by Engineer-Captain W. Onyon, R.N. (ret.).

Women's Engineering Society.—September 15th to 17th. Shipping, Engineering and Machinery Exhibition, Olympia, W. Fifth Annual Conference.

Model Engineers' Exhibition.—September 17th to 24th. Royal Horticultural Hall, Westminster, S.W.

National Radio Exhibition.—September 24th to October 1st. Olympia, W.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

FARADAC medical apparatus.

Notes.

B.E.S.A. Publication.

The British Engineering Standards Association has just issued a Specification for Street Lighting. It provides a basis upon which street-lighting installations can be compared, tenders invited, and installations tested on an equitable basis, and specifies the technical conditions applying to the maintenance and testing of street-lighting installations under service or working conditions. It has not been possible to sectionalise the clauses of the specification to suit all conditions, and it has been left to the parties concerned, supply authorities, manufacturers, and so on, to adopt such clauses as meet the needs of possible contracts. It was decided to omit altogether from the categories of the specification a type of lighting—sometimes spoken of as "beacon" lighting—in which lamps are placed at such wide intervals that they indicate the edge of the road rather than illuminate the highway or the vehicles and pedestrians using it. Street-lighting installations are divided into eight classes, the last of which, II, is not recommended for streets which are likely to be used appreciably for through-traffic. A minimum height of the light source above the ground and a maximum spacing-height ratio are specified. The question of glare has received a good deal of attention from the Committee, and, whilst it is recognised that until a much more fundamental investigation has been made of the subject nothing very definite can be specified, a method for estimating the approximate amount of glare from a given installation has been devised and put to some practical tests; this is included as an appendix. Prior to its issue the specification was given a very wide circulation, over 1,000 copies having been distributed to the various institutions and associations interested and their comments invited; in principle it was most favourably received. The comments received were too numerous to answer individually, but they were all most carefully considered by the Committee, which thanks all those concerned for their constructive suggestions. Some quite radical changes were made in some of the clauses as the result of the criticisms received. It is not anticipated that this is the final word on the subject, and it is hoped that as this specification is put into use proposals for its improvement will be sent to the secretary. The attention of those who received copies of the first printed proof of the specification for comment is called to the fact that the published specification contains many quite important changes. Copies of the specification, No. 307—1927, can be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d., post free.

Correction.

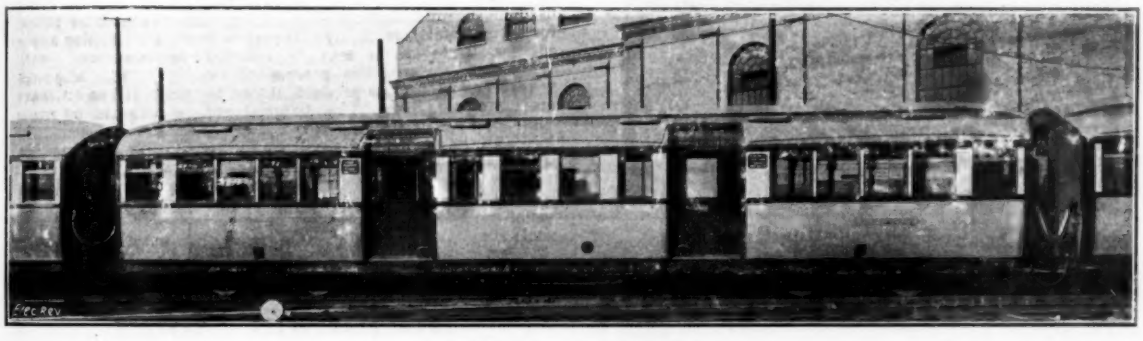
Our attention is drawn to two errors in the article on "A Large Meter Department," by Mr. E. Jacobs, published in our issue of July 22nd last. On page 134 the term "power factor," line 8, and the term "load figure," line 11, should each read "load factor."

Industrial Welfare Lecture Conference.

A lecture conference, under the auspices of the Industrial Welfare Society, commences to-day (Friday) at Balliol College, Oxford, and will continue until Wednesday next. The addresses cover a number of aspects of industrial welfare, and the speakers include Sir Harold Morris, K.C., M.B.E., President of the Industrial Court, Sir Richard Terry, Mus.Doc., the Rev. Robert R. Hyde, Messrs. Sydney Walton, G. W. Reid, R. A. Burrows, F. W. James, and H. C. Emmerson, Mrs. Barbara Wootton, Miss G. F. McArthur, and Miss G. Burlton.

Reconstruction of Central London Railway Cars.

About a year ago the Underground Company expressed its intention of remodelling the whole of the rolling stock on the Central London Railway, so as to bring it up to the same standard of comfort and efficiency as the new stock now in service on the Hampstead and City lines. In all, 120 cars have now been reconstructed and placed in service, and work on the remaining 139 cars is being pushed forward with all speed. This constitutes, approximately, twenty reconstructed trains. The reconstructed stock has been found particularly serviceable in dealing with the heavy traffic which arises when there is greyhound racing at the White City. The specially wide doors



New Central London Railway Car.

which are fitted render ingress and egress more speedy, thus permitting a closer-interval train service to be worked.

The improvements include new upholstered seats, pneumatically operated doors, better lighting, improved ventilation, and smoother starting. The manually operated gates at the ends of the cars have been taken away, and the whole platform has been enclosed for inclusion in the seating place. The air-operated doors are sited with a view to facilitating quicker loading and unloading of the cars at stations. As a result of the above modifications, the general appearance of the cars has been considerably improved.

132,000-V Cable in Commission.

On August 9th the new Pirelli 132,000-volt cable line which connects the Hell Gate station of the United Electric Light and Power Company with the Dunwoodie sub-station of the New York Edison Company was officially put into service. The cable, which is of the Pirelli hollow-core oil-filled type, described in the ELECTRICAL REVIEW of February 26th, 1926, p. 349, is twelve miles in length and capable of transmitting over 130,000 horse power. The line comprises three single-core lead-sheathed cables installed in ducts. Half of the cable was manufactured by Messrs. Pirelli and shipped to America, while the remainder was manufactured by the General Electric Co. under arrangements with Messrs. Pirelli. The line was installed by the New York Edison and the United Electric Light and Power Companies under the supervision of the Pirelli and General Electric Companies' engineers. The cable will supply all the electric services for over 300,000 people, and is capable of delivering more power than could be furnished by the largest single electrical generator that has ever been built. It is of interest to note that a similar line six miles in length was placed in service in Chicago in June last, and has proved entirely satisfactory. It will be recalled that an announcement was made in our description of the cable to orders having been placed for it by the N.Y. Edison Co., and for Chicago.

Fatalities.

The Times reports that two miners, Robert Connor and Robert Laird, were killed on September 1st by electric shock in No. 5 Rosehall Colliery, near Airdrie. Apparently they touched a live wire whilst working at coal-cutting machines.

On August 30th a boy, named Donald Williams, aged 14, at Newport (Mon.) was found dead in his bedroom, wearing headphones attached to a crystal radio set. At the inquest on September 5th evidence was given that he had a wire in his mouth, and there was a mark like a burn inside his lip. A reading lamp stood beside the bed, and the flexible was wound round the iron bedpost. Several persons felt shocks when handling the lamp, or touching the bedstead, and the flexible was frayed in several places.

Mr. D. S. Richards, sales and installation engineer to the Newport Corporation, according to the *Daily Telegraph*, tested the electrical installation and found it perfectly satisfactory, but the earthing connection of the lead sheathing had been disconnected from the water pipe. In the consumer's main fuse he found that a piece of thin copper wire had been inserted, whilst a smaller piece had been attached to the distribution board. The switches were connected on the neutral side of the supply. At one time there had been some trouble with the ground-floor light, and someone who did not know anything about it had tried to put it right. There was a defect in the flex leading to the lamp; if that were brought into contact with the bedstead the latter would come within the circuit. If anyone then came into contact with the bedstead and earthing, he would receive the full force of the charge, which at the time was 230 volts. The death of the boy was due, in his opinion, to the leakage of the flex. Had the installation been left as the Corporation left it, it would have been perfectly safe.

Dr. Alfred Arthur said his examination of the boy led him to the conclusion that he had been killed by electric shock, and that death was instantaneous.

Mr. J. O. Rhodes, an electrical-medical specialist, stated that he attributed the cause of the accident to the switch being on the neutral side, and the flex being defective. He had heard that one was able to hear better by putting the wire in the mouth.

Summing up, the coroner said that a crystal wireless set was a perfectly harmless apparatus. He did not think that anyone who used a crystal set need have the slightest apprehension of any danger provided he did not use the wire as this lad had done. As flex was being used by the mile throughout the country, it behoved everyone to see that it was periodically overhauled to guard against its becoming worn, and the insulation becoming defective. The boy appeared to have known a little too much.

A verdict of "Accidental death" was returned.

Electrical Power Engineers' Association.

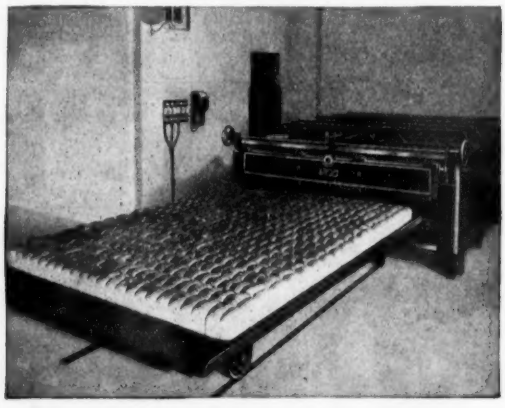
SOUTHERN DIVISION.—The ninth annual dinner will be held at the Hotel Cecil, Strand, W.C., on Saturday, October 8th, at 6 p.m.

The International Electrotechnical Conference in Italy.

Our special correspondent at the I.E.C. Conference telegraphs from Bellagio that the delegates arrived on Sunday afternoon, September 4th, at Como, whence a special steamboat, gaily decorated with flags, conveyed them to Bellagio, a journey of an hour and a quarter; unfortunately "the weather was as bad as the English summer has been," and rain prevented full enjoyment of the beautiful lake scenery. The British delegates were summoned to a special meeting at 8.30 p.m., presided over by Mr. Roger T. Smith, to settle matters relating to the organisation. At nine o'clock the meeting was opened by the Podesta of Bellagio, who welcomed the delegates (numbering 220, and accompanied by 90 ladies) to that beautiful city and wished them full enjoyment during the time that they remained there. Professor Lombardi expressed the delight felt by the Italian technologist in receiving as visitors such illustrious members of his own profession from abroad; he addressed the assembly both in English and in French. Prof. Lombardi was followed by Mr. G. Semenza, representatives of the Italian Ministries, and by Colonel R. E. Crompton. The large reception room at the Grand Bretagne Hotel was filled, and microphones with four loud-speakers were arranged in different parts of the room to enable the speeches to be comfortably heard. It was past eleven o'clock on Sunday evening when the first day's work was finished, and Mr. Le Maistre, general secretary, expressed satisfaction at the successful beginning. On Monday morning committee work was commenced, which continued until six o'clock; there was to be a garden party at nine o'clock, and, as the weather had improved, it was hoped that the function would be attended by all the delegates. On Tuesday morning at 8.30 an official photograph of the delegates and their lady companions was to be taken.

An Electric Bread-baking Oven.

The saving in labour and the elimination of all fuel, which requires handling and storage room, would alone suffice to commend the use of electric industrial bread-baking ovens, apart from their convenience and economy. A recent introduction is the "drawplate" type of oven. The accompanying illustration shows an oven of this type made by the General Electric Co., Ltd., and installed in the premises of the United Co-operative Baking Society, Glasgow, at the beginning of this year. It is capable of making 480 2-lb. Scotch loaves at one time, so that the weight of wet dough placed on the "drawplate" is over 1,000 lb. per charge. The overall dimensions of the oven are, approximately, 5 ft. 6 in. high, 10 ft. 6 in. wide, and 15 ft. 6 in. deep; the weight of the complete



A "Drawplate" Electric Oven.

unit is, roughly, 10 tons. The actual drawplate area of the oven is 12 ft. 6 in. by 8 ft. 6 in., the oven space being 13 ft. by 8 ft. 10 in. Inspection lights are provided so that the contents may be examined through the spy-hole in the door, which is so arranged that it may be closed when the drawplate has been withdrawn, thus conserving the heat. The maximum loading of the apparatus is 56 kW, and the patent elements, which are of the standard pattern used in the "Magnet" peel ovens, are arranged to give top and bottom heat. These elements are contained in steam-tight tubes running the whole length of the oven interior, and the process of changing the elements for a different voltage is precisely the same as with the peel equipment. The fuel cost compares very favourably with other methods, irrespective of the many advantages derived from the use of electricity. The illustration, of course, shows the drawplate removed from the oven.

Educational.

Courses in wireless and high-frequency engineering at the Polytechnic, Regent Street, will commence on September 27th. They extend over a period of five years, and include a preliminary first-year course for the elementary student. The head of the Electrical Engineering Department, Mr. Philip Kemp, M.Sc. (Tech.), and his staff will be in attendance to advise and enrol students from 6 to 8.30 p.m. on September 15th to 24th (except 18th).

Hackney Institute.—Electrical Engineering Department. The 1927-28 session commences on September 26th. Particulars on application at the Institute, Dalston Lane, E.8.

L.C.C. School of Engineering and Navigation.—Classes in electrical engineering and electrical installations. Session commences September 26th. Enrolment during week commencing September 19th. Prospectus and full particulars from the secretary at the school, High Street, Poplar, E.14. (See our advertisement pages to-day.)

Appointments Vacant.

Mains superintendent (£400) for the Aylesbury Corporation Electricity Department. Probationary assistant telegraph engineer for the Government of the Federated Malay States. Shift charge engineer for the County Borough of Barrow-in-Furness, electricity department; chief technical assistant (£700) for the Corporation of Glasgow Electricity Department. (See our advertisement pages to-day.)

Specialised Information: the "ASLIB" Conference.

It is expected that some 200 organisations will be represented at the fourth conference of the Association of Special Libraries and Information Bureaux, which meets at Trinity College, Cambridge, during the week-end, September 23rd-26th. Following a reception by Sir J. J. Thomson, O.M., Master of Trinity, Sir Geoffrey Butler, K.B.E., senior M.P. for Cambridge University, will deliver the presidential address; among the many well-known experts reading papers are Sir Henry Lyons (Director, the Science Museum), Mr. A. E. Overton (Principal, Board of Trade), and Sir Richard Gregory (editor of *Nature*). The subjects to be discussed at the Conference include such topics as the recent report of the Public Libraries Committee, co-operation between libraries, and book selection in science and technology. Sectional meetings will be held on information and statistics in commerce and industry, on patent classification, and on information bureau questions. The Conference will be open to all interested, whether members of the Association or not; a copy of the detailed programme and other particulars can be obtained from the secretary, ASLIB, 38, Bloomsbury Square, London, W.C.1.

With the assistance of the Carnegie United Kingdom Trustees the Association is publishing in the autumn a "Directory of Sources of Specialised Information," edited by Mr. G. F. Barwick, late Keeper of Printed Books at the British Museum. The book is unique in character inasmuch as it records under thousands of subject headings the various centres in Great Britain and Ireland to which those in search of specialised information should turn.

A New Insulating Material.

A new type of insulating material, "Mycalex," which is being used by the General Electric Company of America for the production of radio high-frequency insulators, not only solves the problem, it is claimed, of finding a suitable insulator for such high frequencies as are encountered in radio work, but also results in the more efficient utilisation of materials. Mycalex is a composition of ground mica and lead borate, and has better insulating properties than porcelain. It is light grey in colour, has a metallic ring, and is being used in the manufacture of bases for radio transmitter tubes, for aerial insulators in high-frequency work and similar applications. Metal parts may be inserted or combined with "Mycalex" during the process of moulding, and although a hard and stone-like product, it can be subjected to ordinary machining methods. The material can be softened or made plastic by heating to a dull red, when the plastic mass can be formed into the desired shape by compression in steel moulds. The substance is not as heat resistant as porcelain or mica, but tests indicate that it is superior in this respect to the ordinary moulded insulations. Although it can be machined by the usual methods, it is necessary in some instances to use special tools since the wear is greater than when cutting metals.

Institution Notes.

The Institute of Metals.

The annual meeting of the Institute of Metals is being held at Derby this week, from September 6th to 9th, under the chairmanship of Sir John Dewrance, K.B.E. In an opening lecture on "Metals in Modern Transport," Dr. L. Aitchison said that the reasons for the employment of the non-ferrous metals in our various systems of transport were very similar to those that govern their utilisation in all other branches of engineering. The properties that led to the greatest employment of the non-ferrous metals and alloys were: High resistance to corrosion, high values of thermal or electrical conductivity, and low values of specific gravity. A high resistance to corrosion was a conspicuous feature of nickel and its alloys. These metals were not very extensively used in connection with transport systems, but a fairly prominent example of this service was found in cupro-nickel condenser tubes. Many examples of good resistance to corrosion were found in the alloys of copper. Typical illustrations of the use of this metal and its alloys on this account occurred in condenser tubes and turbine blading, as well as in gun-metal and phosphor-bronze castings.

In a paper on "The Protection of Aluminium and its Alloys against Corrosion," by H. Sutton, M.Sc., and A. J. Sidery, some experiments are described in which samples of aluminium and aluminium alloys were treated by various protective processes, including anodic oxidation, zinc-, cadmium-, and nickel-plating. Certain practical features of the methods investigated and also the results of corrosion tests extending over periods of one to two years, are discussed. The resistance of aluminium, Duralumin, and of certain other aluminium alloys to corrosion by sea-water is considerably increased by anodic oxidation and the subsequent application of a grease such as lanoline. Electro-deposited coatings of zinc, 0.0005 in. thick, afforded better protection to aluminium than did coatings of cadmium of similar thickness, but the two types of deposit appeared to give an approximately equal degree of protection when applied to alloys of aluminium. Unsatisfactory results were obtained from nickel deposits of normal thickness.

In a paper on "The Nature of the Film Produced by Anodic Oxidation of Aluminium," by H. Sutton, M.Sc., and J. W. W. Willstrop, B.Sc., a method is described of isolating the film from anodically treated aluminium. The metallic aluminium is volatilised in dry hydrogen chloride. The films isolated from treated commercial aluminium sheet are usually of a grey colour, due to traces of carbon left behind when the aluminium sublimes as chloride. The presence of elementary silicon in films produced on commercial aluminium is also shown.

A paper by Cyril S. Smith, D.Sc., "Note on Cathodic Disintegration as a Method of Etching Specimens for Metallography," deals with the phenomenon of cathodic sputtering, which can be used to develop the structure of metal specimens for microscopic examination.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. E. GURNEY BUXTON has been elected a director of Callender's Cable and Construction Co., Ltd.

Mr. B. L. MYER, A.M.I.E.E., has resigned his position as Liverpool representative for Messrs. Falk, Stadelmann & Co., Ltd., and has been appointed managing sales engineer for Messrs. Power Centre Co., 15, Park Lane, Liverpool, manufacturers of all-steel patent switchboards.

Mr. A. F. ANDERSON, A.M.I.E.E., has been appointed engineer of the Walton-on-Thames electricity supply undertaking, which is being taken over by the Urban District Council from the Urban Electric Supply Co., Ltd. Mr. Anderson has been resident electrical engineer to the Amble Urban District Council for the past four years, and was selected for the Walton appointment from 252 applicants.

Mr. ROBERT D. SPANTON, who served his apprenticeship at the Whitby Electricity Works, and who has since 1917 held a Government appointment at Hong Kong, has been appointed station supervisor at the Armament Depôt at Crombie, Scotland.

Sir VINCENT CAILLARD, who for 27 years has been a director of Vickers, Ltd., and who was mainly instrumental in arranging for the recent reconstruction of the company (which is now practically completed), has resigned his seat on the board as from September 1st.

Mr. J. W. DUNNING, of Liverpool Corporation Tramways, has been appointed chief traffic assistant to the Cardiff Corporation Tramways Department. Mr. Dunning won the 1926-27 prize and medal of the Municipal Tramways Association for a paper on traffic problems. Before leaving Liverpool last week he was presented with a clock.

According to the *Sydney Morning Herald*, Mr. G. F. HOYLAND, who has been investigating conditions in Australia on behalf of the Pirelli-General Cable Works, Ltd., Southampton, arrived at Sydney in July from Brisbane.

Last week the list of 55 applicants for the post of borough electrical engineer at Halifax, rendered vacant by the death on June 16th of the late Mr. W. N. ROGERSON, was reduced to a short list of four.

Mr. JOHN S. LORD, partner in the firm of Lord Bros., electrical engineers, Hebden Bridge, was married on August 30th, at Hebden Bridge, to Miss EDITH BALDWIN, of Dean Hey, Mytholmroyd.

Mr. D. MCDOUGALL, chief assistant, has been appointed interim electrical engineer at Greenock for six months in succession to Mr. F. H. Whysall, now of Belfast. The Greenock Corporation is stated to intend making reductions in the staff at Dellingburn Electricity Works by which a saving of £3,600 a year will be effected.

The "Henley Telegraph" states that Mr. J. H. ROBERTS, accountant to W. T. Henley's Telegraph Works Co., Ltd., is leaving that company on September 24th, after 23 years' service, to take up an important position as secretary to "Cable Research," Imperial House, Kingsway, W.C.2.

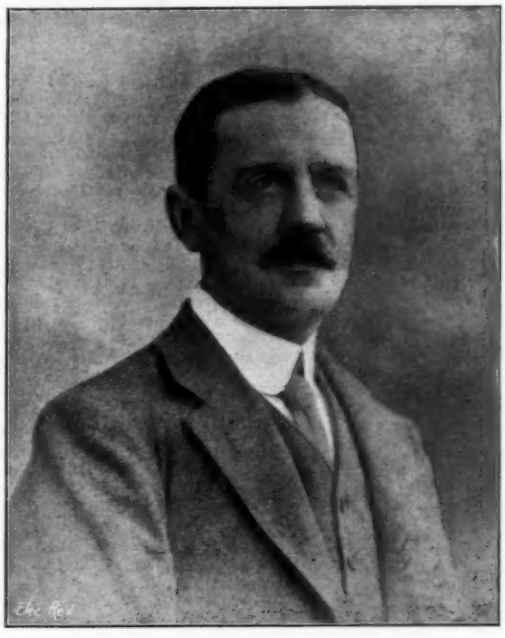
The "Telegraph" also reports the appointment of Mr. D. I. EVANS as buyer to Henley's.

Obituary.—MR. JAMES TAYLOR.—We deeply regret to learn of the death of Mr. James Taylor, J.P., M.I.E.E., which occurred on September 2nd at Colomendy, near Mold, North Wales, at the age of 66 years. Our readers will recall that in March last he was unable, owing to ill-health, to preside over the annual meetings of the British Insulated Cables, Ltd., and other companies of which he was the chairman. An account of Mr. Taylor's career was given in these columns two years ago (ELEC. REV., August 28th, 1925). He began his connection with the British electric cable-making industry nearly 43 years ago, for in 1884 he joined his brother, the late Mr. G. Crosland Taylor, who, in 1883, had commenced the manufacture of cables at the Deeside Electric Works, Neston. Early in 1886 the business was converted into a limited liability company, and the Telegraph Manufacturing Company, of Helsby, was established. Amalgamation with the British Insulated Wire Co., of Prescot, was effected in 1902, and the new title of British Insulated and Helsby Cables, Ltd., was adopted. The name has since been changed to British Insulated Cables, Ltd. Mr. James Taylor had been chairman of the company since 1918. He became an Associate of the I.E.E. in 1889, and a Member in 1898. He was a director of the Automatic Telephone Manufacturing Co., Ltd., the British Aluminium Co., Ltd., Colne Valley Electric Supply Co., Ltd., Electric Supply Co. of Victoria, Ltd., Electrical Finance and Securities Co., Ltd., Foots Cray Electricity Supply Co., Ltd., the International Automatic Telephone Manufacturing Co., Ltd., the Midland Electric Corporation for Power Distribution, Ltd., the National Electric Construction Co., Ltd., the North British Aluminium Co., Ltd., and the Northwood Electric Light and Power Co., Ltd.

The deceased gentleman possessed a most genial temperament which endeared him to a host of friends, and which, combined with his great business ability and unbounded energy, largely contributed to his success. His health broke down in the autumn of last year; a stay at Mentone followed, but all efforts for recovery were unavailing.

Mr. Taylor leaves a widow, two sons and a daughter, to whom we desire to offer, on behalf of a large number of his personal friends and admirers, an expression of sympathy in their bereavement. The eldest son, Mr. H. Taylor, was killed in a motor accident during the war.

The funeral took place on Tuesday at Helsby Parish Church. The church was filled to overflowing, those present including a number of employés who had been engaged at the Helsby works under Messrs. George and James Taylor for between 30 and 40 years. Directors of the British Insulated Cables, heads of departments, representatives of his many companies, villagers, employés on the Colomendy estate, and others, were among the throng of mourners. A guard of honour formed by employés at Helsby and by the members of the Cable Works Fire Brigade extended from the lych-gate up the winding pathway to the church.



The late Mr. James Taylor, M.I.E.E.

The family mourners were Messrs. Alan and Eric Taylor (sons), Mrs. Peyton (daughter), Mrs. Crosland Taylor, the Mayor of Chester, Mr. C. Crosland Taylor (nephew), Mr. John Taylor (London), Mr. J. Dyson Taylor, and Miss Rothwell Taylor. Business associates who were present included Mr. D. Sinclair, director and general manager, British Insulated Cables, Ltd., Messrs. J. Carlton Stitt, and J. Arthur Smith (directors), Mr. G. H. Nisbett (director and engineer), Mr. W. Kerfoot (secretary), Col. D. Bates, works manager at Prescot; Col. Tennant, assistant works manager at Prescot; Mr. John Brotherton, manager, Helsby works; Mr. E. A. Bayles, works manager, Helsby; Mr. B. H. Roberts, deputy manager, and many others.

MAJOR T. VINCENT SMITH.—We regret to record the sudden death of Major Tom Vincent Smith, M.C., M.I.E.E., while attending the opening of the beam wireless station to India at the G.P.O., on Monday last, on behalf of *The Times*, for which he had been acting as wireless adviser for more than two years. Major Vincent Smith, who was 55 years of age, joined the Amalgamated Radio Telegraph Co. in 1906. In 1917 he was placed in charge of wireless at the Air Ministry, and later went to France as wireless officer-in-chief to the Independent Air Force. Since the war he had acted as a consultant on wireless matters, and had been a director of the British Radio Telegraph Co. He had been a member of the Wireless Committee of the Institution of Electrical Engineers, and of the Radio Society of Great Britain, and was a past-president of the National Association of Supervising Electricians. *The Times*, in an appreciation published on Tuesday, describes Major Smith as one of the pioneers in wireless research.

MR. E. DAWSON.—Mr. Edward Dawson, a director of the Anderston Foundry Co., has passed away at the age of 75 years. According to the daily Press his son, Mr. G. W. Dawson, also a director of the same company, died a few days ago.

Wills.—MR. MARTIN COX, a director of Mather & Platt, Ltd., left £44,096 gross and £41,010 net personalty.

Mr. JOHN PLATT, a director of Mather & Platt, Ltd., and other companies, left £119,916 gross and £118,133 net personalty.

It is stated that the late Dr. J. R. ERSKINE MURRAY left £1,355 unsettled personal estate in Great Britain.

Mr. HENRY HARTNELL left £1,637 gross and £1,114 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Dakol Electric, Ltd.—Private company. Registered September 2nd. Capital, £1,000 in £1 shares. Objects: To acquire the benefit of certain existing inventions relating to illuminating services for simulating daylight, to adopt an agreement between A. R. St. Clair of the first part, Rowells (1924), Ltd., of the second part, and J. Moffett of the third part, to develop and turn to account the business of electric light engineers formerly carried on by Arthur Reginald St. Clair & Rowells (1924), Ltd., of Newcastle-upon-Tyne, and to acquire the trade mark, "Dakol." The directors are: A. R. St. Clair, "Arncliffe," Waterford Crescent, Whitley Bay, electrical engineer (consultant technical adviser); R. H. Rowell, "Deneside," Rosebury Crescent, Newcastle-upon-Tyne, engineer, managing director (both permanent). Qualification, £100. Registered office: 23, Byron Street, Newcastle-upon-Tyne.

F. J. Jones & Co., Ltd.—Private company. Registered September 2nd. Capital, £5,000 in £1 shares. Objects: To acquire the business of electrical engineers and electricians and dealers in electrical apparatus carried on by S. Thornton, N. E. Webster, O.B.E., and A. E. Ashworth, at Chester and elsewhere, as F. J. Jones & Co., as successors of F. J. Jones and Sons, Ltd., and the goodwill of such business and certain premises held on lease or tenancies in the said city wherein the said business is carried on, and to carry on the same and the business of mechanical and wireless engineers, contractors, suppliers of electricity, &c. The first directors (to number not fewer than three nor more than seven) are:—S. Thornton, 3, Beechley Road, Wrexham, electrical engineer; N. E. Webster, O.B.E., Broughton Hall, Broughton; A. E. Ashworth, Park View, Chester Road, Wrexham, electrical engineer; J. Taplen, Claremont, Walpole Street, Chester, printer.

Mieres, Ltd.—Private company. Registered September 1st. Capital, £1,200 in £1 shares. Objects: To acquire any invention relating to the manufacture, application and use of electric power accumulators, to adopt an agreement between the Rev. Father Almeida and Manuel Loring Count de Mieres of the first part, W. Paulton of the second part, and the company of the third part; to carry on business as chemists, electricians, mechanical engineers, suppliers of electricity, &c. The subscribers (each with one share) are:—J. Bennett, 2, Bond Court, Walbrook, E.C.4; clerk; E. J. Alldis, 2, Bond Court, Walbrook, E.C.4, clerk. The first directors (to number not fewer than three nor more than nine) are to be appointed by the subscribers. Solicitors: Linklaters and Paines, 2, Bond Court, Walbrook, E.C.4.

H. Masterman & Co., Ltd.—Private company. Registered August 27th. Capital, £1,000 in £1 shares (500 7½ per cent. preference and 500 ordinary). Objects: To carry on the business of electrical, lighting, heating, wireless, mechanical and general engineers, and engineering contractors, &c. The permanent directors are:—H. Evans, 47, Cambridge Street, Normanton; H. Masterman, Regent Buildings, Castleford. Qualification, £100 shares. Solicitor: A. Butler, Strand Buildings, Castleford.

"Winkworth" Electric Car-Bells, Ltd.—Private company. Registered August 27th. Capital, £100 in £1 shares. Objects: To acquire the business of a manufacturer and distributor of electric car bells carried on by F. Winkworth at 82, Victoria Street, S.W.1, and at Ascot, Berks. The first directors are:—F. W. H. Winkworth, 82, Victoria Street, S.W.1, engineer; Miss N. L. E. Winkworth, Riverside House, Staines, Middlesex. Solicitor: J. S. Winkworth, 5, Finsbury Square, E.C.2.

B. E. I., Ltd.—Private company. Registered August 31st. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric body batteries, surgical instruments, &c. The directors are:—W. Hughes, 70, Oxford Avenue, Raynes Park, S.W.20; R. H. Forbes, 14, London Road, Clapton, E.5. Qualification, one share. Remuneration, £50 each per annum. Secretary: L. Beere. Registered office: 25, Holborn Viaduct, E.C.1.

Official Returns of Electrical Companies.

South Metropolitan Electric Light and Power Co., Ltd.—Capital, £1,100,000 in £1 shares (850,000 ordinary, 150,000 cumulative first preference, and 100,000 cumulative second preference). Return dated April 19th, 1927 (filed July 27th). 600,000 ordinary, 150,000 first preference, and 100,000 second preference shares taken up. £492,132 paid. £357,868 considered as paid. Mortgages and charges, £374,090.

Telephone Manufacturing Co., Ltd.—Satisfaction in full on July 26th, 1927 (*a*) of trust deed dated February 17th, 1922, securing £300,000, (*b*) of trust deed of same date securing £10,000 debentures and premium of 2 per cent., and (*c*) of trust deed of same date securing £20,000 debentures and premium of 2 per cent.

Capital, £1,000,000 in 10s. shares. Return dated July 1st, 1927. All shares taken up. £690,000 paid. £310,000 considered as paid. Mortgages and charges nil.

Bells Radio & Electrical Co., Ltd.—Capital, £4,000 in £1 shares. Return dated March 5th, 1926 (filed July 1st, 1927). All shares taken up. £3,187 10s. paid (being 19s. 6d. per share on 3,500 shares). £487 10s. considered as paid (being 19s. 6d. per share on 500 shares). £225 calls unpaid. Mortgages and charges nil.

Herrick Durell & Co., Ltd.—Mortgage or charge on the company's undertaking, present and future, including uncalled capital, dated August 20th, 1927, to secure £1,650. Holder: A. C. Trill, 1, Honiton Road, Queen's Park, N.W.2.

Leicol, Ltd.—Debenture dated August 10th, 1927, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. Wilde, 4, Marmaduke Street, Edge Hill, Liverpool.

Lancashire Dynamo and Motor Co., Ltd.—Capital, £320,000 in £1 shares (260,000 ordinary and 60,000 preference). Return dated April 26th, 1927 (filed June 14th). 245,400 ordinary and 58,800 preference shares taken up. £304,200 paid. Mortgages and charges, £75,000.

Attaix, Ltd.—Debenture dated August 23rd, 1927, to secure £400, charged on the company's property, present and future, including uncalled capital, but excluding 106, High Street, Southampton. Holder: H. Benger, South Western Hotel, Southampton.

J. T. Kemp, Ltd.—Particulars filed of £1,050 debentures authorised August 17th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Oakham Gas and Electricity Co., Ltd.—Particulars filed of £10,000 debentures authorised July 9th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Satisfaction in full on August 19th, 1927, of debentures dated July 31st, 1908, and May 27th, 1922, securing £2,900 and £1,400 respectively.

Haworth & Williams, Ltd.—E. Hope, C.A., of Willow Street, Accrington, Lancs., was appointed receiver on August 19th, 1927, under powers contained in mortgage debentures dated July 23rd, 1925.

British Di-Electric Co., Ltd.—E. R. Wyer, of 57, Copthall House, Copthall Avenue, E.C.2, was appointed receiver on August 16th, 1927, under powers contained in debentures dated December 4th and 9th, 1926.

Beck & Moss, Ltd.—Capital, £2,500 in £1 shares. Return dated March 5th, 1927 (filed July 27th). All shares taken up. £525 paid. £1,975 considered as paid. Mortgages and charges, nil.

Macos Battery Manufacturing Co., Ltd.—Debenture dated August 26th, 1927, to secure £2,000, charged on the company's property, present and future, including uncalled capital. Holder: Mrs. A. Foster, 1, Clements Road, E.6.

Dorset and Devon Electricity Supply, Ltd.—Particulars filed of £2,000 debentures authorised by resolutions of August 2nd and 16th, 1927, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,000.

New General Traction Co., Ltd.—Capital, £262,000 in £1 shares. Return dated July 15th, 1927. All shares taken up. £250,000 paid. £12,000 considered as paid. Mortgages and charges nil.

Tisbury Electric Supply Co., Ltd.—Capital, £6,000 in £1 shares. Return dated June 3rd, 1927. All shares taken up. £6,000 paid. Mortgages and charges nil.

Chagford and Devon Electric Light Co., Ltd.—R. Waycott, of Victoria Street, Paignton, Devon, was appointed receiver by order of court dated August 17th, 1927.

County Electrical and Wireless Stores, Ltd.—Capital, £7,000 in £1 shares. Return dated August 12th, 1927. 1,000 shares taken up. £1,000 paid. Mortgages and charges nil.

Skegness Electricity Supply Co., Ltd.—Capital, £1,000 in £1 shares. Return dated May 4th, 1927. 705 shares taken up. £705 paid. Mortgages and charges £550.

Mersey Cable Works, Ltd.—Satisfaction to the extent of £1,100 on May 31st, 1927, of mortgage dated October 12th, 1926, securing £5,500.

City Notes.

Anglo-Portuguese Telephone Co., Ltd.

The directors state that the Connaught Trust, Ltd., has acquired about a third of the company's 7 per cent. first mortgage convertible debenture stock (which carries an option to subscribe to a further £100,000 of stock) and more than half of the issued ordinary capital. "The directors and the new majority shareholders believe that the company's business in Portugal admits of profitable development on a considerable scale" and it is consequently proposed to reorganise the capital. The suggestion is to increase the capital to £1,100,000 by the creation of 200,000 new ordinary and 100,000 "A" ordinary shares of £1 each, the latter class to be exchanged for debenture stock. The ordinary shares will rank for dividend before the "A" shares, being entitled to the first 8 per cent. declared. The "A" shares will then receive the next 8 per cent. Any future advantages will be shared between the two classes. Arrangements have been made for the Connaught Trust to exchange its debentures for shares, and to underwrite the first £100,000 of any new capital issued within a year. A meeting to consider the proposals will be held at Winchester House, E.C.1, on September 14th.

Stock Exchange Notices.

Dealings in the following securities have been specially allowed by the Stock Exchange Committee under Rule 159:—

Erinoid.—34,722 shares of 5s. each, fully-paid, Nos. 965,279 to 1,000,000.

Pinchin, Johnson & Co.—105,000 ordinary shares of £1 each, fully-paid, Nos. 540,001 to 645,000.

The undermentioned have been ordered to be officially quoted:—

Erinoid, Ltd.—34,722 shares of 5s. each fully paid, Nos 965,279 to 1,000,000.

North Metropolitan Electric Power Supply Co.—425,000 ordinary shares of £1 each fully paid, Nos. 850,001 to 1,275,000.

Pinchin, Johnson & Co., Ltd.—105,000 ordinary shares of £1 each fully paid, Nos. 540,001 to 645,000.

Underground Electric Railways Co. of London, Ltd.

The holders of the company's 6 per cent. income bonds have been informed that they should defer depositing their bonds for endorsement or for exchange into fully-paid ordinary shares until after the necessary increase in the share capital of the company has been effected in general meeting; this meeting will be convened shortly.

Elliott's Metal Co., Ltd.

The profit for the year ended June 30th amounted to £57,162, as compared with £70,240 in 1925-26. The interim ordinary dividend was passed, but it is proposed to pay a dividend of 10 per cent., equal to the total distribution of each of the past three years. A sum of £10,000 reserved for income tax and not now required, is transferred to the special depreciation and works renewals reserve.

Moroccan Company.

Energie Electrique du Maroc.—This company has been authorised to issue 60,000,000 francs' worth of 7 per cent. 25-year debenture stock. It is reported that the stock will be in 500 fr. shares, which will probably be issued at the price of 460 fr. The half-yearly interest is to be guaranteed by the Shereefian State.

Czecho-Slovakian Company.

The report of the *Krizik Electrical Engineering Co.*, Prague, for the past financial year shows net earnings of 4,516,466 crowns, as compared with 3,802,571 cr. in 1925. A dividend of 7 per cent., as against last year's 5 per cent., has been declared. At the recent annual general meeting approval was given to the incorporation of the Bergmann Electricity Works, Podmokly, the shares of which, to the nominal value of four million crowns, have been in the possession of the Krizik Co. since 1919.

Brazilian Traction, Light and Power Co.

A quarterly dividend of 1¼ per cent. has been declared on the cumulative preference shares.

Davis & Timmins, Ltd.

An interim dividend at the rate of 6 per cent. per annum, tax free, is recommended on the ordinary shares, as in 1926.

English Electric Co., Ltd.

The directors announced last week that they were unable to recommend the payment of an interim dividend on the preference shares.

Rangoon Electric Tramway and Supply Co., Ltd.

An interim dividend of 8 annas per share, free of Indian income tax, has been declared on the ordinary shares, as in 1926.

Clarke, Chapman & Co., Ltd.

An interim dividend of 2 per cent. has been declared on the ordinary shares, against *nil* in 1926.

Western Telegraph Co., Ltd.

A final dividend of 5s. per share has been declared, making a total distribution of 10 per cent., free of tax, for the year.

Stocks and Shares.

MONDAY EVENING.

THE boom in the industrial markets of the Stock Exchange received something of a setback by reason of a bout of profit-taking that occurred as this week's settlement approached. Some of the exuberant enthusiasm which had been shown during the previous fortnight gave way to a more sober feeling, and people began comparing current quotations with the yields offered by industrial shares on the basis of the last-paid dividends. These, as it has been pointed out here on several recent occasions, are decidedly modest in many cases, and although the prospect is deemed to hold considerable hopes of expanding prosperity in the future, the wave of optimism which has carried up prices to their present figures requires fresh stimulus from buyers in order to maintain its force.

To take one example, English Electric ordinary shares were run up to 14s. upon what seemed to be very unsubstantial grounds, and the price went back to 10s., upon the posting of a telegram in the Stock Exchange to the effect that the company would postpone payment of the interim dividend on the preference shares. Nothing has been paid on these since a year ago. The last time the shares went ex dividend was September 13th, 1926, and the ordinary have received nothing since May, 1925. It is more than probable that the company is doing a great deal better now than was the case a year ago, but anticipation certainly ran fast in raising the ordinary to the price mentioned, and disappointment with the company's announcement led to a reaction which can only be regarded as natural in the circumstances. Violent fluctuations in such shares as these are due more to speculation than to speculative investment. In companies whose shares are held by investors pure and simple, the reactionary price tendency is due to selling by those who regard present prices as being high enough, in view of the dividends paid. Such is the cheerfulness felt, however, in regard to the outlook for industrial shares that many people anticipate an early resumption of the rise that took place during August, particularly if there should be any solid justification for the assumption that amalgamations, or their equivalents, are contemplated.

Equipment and Electricity Supply Shares.

Brush ordinary, Callender's, Henley's and Siemens are amongst those which have suffered small falls. India Rubber shares, Metropolitan-Vickers ordinary, and Electric Constructions are better. The general disposition is slightly irregular. With excitement running high in connection with a good number of industrials, the investor finds it hard to resist the temptations offered by the popular speculative media: he is inclined to sell part of his good shares in order to employ the money in other things which, if less sound in security, offer the opportunity for making the "quick turn" desired by the present-day capitalist. It says much for the faith of finance in the London electricity supply shares that these latter should not have been turned out to make room for more volatile descriptions. Prices are steady, the shares being so firmly held that there is but one change on the week, and this is a gain of 6d. in Metropolitans. Urban ordinary

have been again in request; the price is 1/16 higher at 28s. 9d. on the hope, already quoted here, that bonus distributions will be made on these and Edmundsons.

Traction and Tramway.

Brazilian Tractions are 5½ higher at 191; there seems to be no stopping the rise in these shares. At 159 the 6 per cent. preference are up 4½ points. Barcelona Tractions achieved a new record at 69½; the first mortgage bonds are 75 and the 6½ per cent. prior-liens 101½. The Mexican utilities are strong, with Mexican Light and Power common showing a gain of 5 at 45½. Mexican Tramways fives at 72 are ex the half-yearly coupon. British Columbia Electric Railway stocks creep up steadily. British Electric Traction preferred ordinary has strengthened to 120½. On the other hand, the London traction division has eased off, London and Suburban Traction preference to 10s. and London United Tramways preference to 8s. 6d. The latter company's ordinary shares have been changing hands at 1s. 9d. A little business took place in Metropolitan Tramways 5 per cent. preference on the basis of half-a-guinea; the ordinary have changed hands at sixpence, three months ago. A transaction was marked the other day in Torquay Tramways 5 per cent. debentures at 86, and Imperial Tramways 4½ per cent. debenture stock was negotiated at 59 early in August.

Provincial and Foreign Trams.

Amongst the less-familiar tramway, &c., securities, it may be of service to mention that British Automobile 8 per cent. participating preference are 25s. 6d. and the 5½ per cent. debenture stock is 91½. Bath Electric Tramways preferred ordinary are 4s. 6d., the 5 per cent. cumulative preference 10s., and the 4½ per cent. debenture stock 66½. Hastings and District Electric Trams stand at eighteenpence to a florin; these are 10s. fully-paid shares, the 6 per cent. preference, quoted at 8s. 9d., being of £1 denomination. The 4½ per cent. debenture stock is nominally about 50. La Plata Trams, from which all the recent speculative interest has subsided, are barely 4s. 6d., though the 6 per cent. preferences retain their price at £1. Lisbon Electric Tramways ordinary seldom vary from 20s., and the 6 per cent. preference are 15s. The 5 per cent. mortgage debentures were sold, about three weeks back, at 70. Shanghai Electric Constructions remain at 37s. 6d. Rio Tramways 5 per cent. firsts are 98½, some ten points higher than the 5 per cent. 50-year mortgage bonds. Sao Paulo Tramway, Light and Power first mortgage debentures marked 101½ a few days ago; the company's 5 per cent. perpetual consolidated debenture stock is 86½. Cape Electric Trams at 18s. 9d. are lower on the week.

Tube Speculations.

Underground Electric Railways of London 6 per cent. income bonds went ex dividend on September 1st, and are now standing at par. Something of a pause has occurred in the market activity of the shares, with a resultant drop to 18s. 6d. in the price. Speculators who have been following the shares feel a little uncertain as to what may be the immediate effect of the lately-passed scheme in connection with the 6 per cent. income bonds. The optimistic view is that last year's dividend on the shares, of 1½ per cent., will be advanced to 5 per cent. in respect of 1927. If so substantial an increase of 3½ per cent. is made, the shares will still look tolerably well-valued at 18s. 6d., but, on the other hand, these Bus "A" shares have always been accustomed to stand at levels that discount the future for a long way ahead. Metropolitan Railway consolidated stock has parted from a point of its recent considerable gain, and Districts are unchanged at 62½.

Telegraphs and Telephones.

The only movements amongst cable stocks and shares is an unimportant decline to 18½ in Globe ordinary shares. Eastern issues are very quiet and business in them has dwindled to a humdrum, bread-and-butter affair. United River Plate Telephones have gone back 5s. to 10½. Lively dealings in Automatic Telephones and Internationals are taking place. The latter strengthened to 45s. for the ordinary: and at 2½ the "B" shares are a shade lower. International Telephone and Telegraph shares put on 2½ points, to 152½. New York has been running a mild excitement on its own account in various industrials. Shawinigan Water shares have hardened to 92. Montreal Light & Power are better at 94½.

Inauguration of the Beam wireless service to India had the effect of attracting attention to Marconis, and the price improved to 20s. Marconi Marines hold their last week's gain, at 28s. 9d., upon expectation of an increase in the next dividend. Johnson & Phillips are better, at £1. The rubber share market is dull for want of something to do: its sister section, dealing with tea shares, is buoyant and excited. Amongst iron, coal, and steel descriptions, the tendency is somewhat halting. The market derived no assistance from Mr. Winston Churchill's optimisms of last Saturday in references to trade, and his declaration that "British industry is once more in full swing." Vickers eased off to 11s. 3d. Babcocks keep their price at 52s. 6d., at which they have now remained for some time. The Stock Exchange settlement to be concluded on Thursday in this week is one of the heaviest that has occurred in recent years, so far as industrial shares are concerned. But in other markets, there is not much doing.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Sept. 5 1927.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	14	14	27/-	—	4 18 8
Brompton Ordinary	1	10	8¾	24/6	—	5 14 3
Charing Cross Ordinary	1	15	8½	25/6	—	5 9 10
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8¾	25/-	—	5 12 0
City of London	1	15	10	29/6	—	4 15 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	30/6	—	5 5 0
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	8	10	37/6	—	5 6 8
do. 7% Pref.	1	6	7	24/6	—	5 14 3
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/6	—	5 9 10
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 8
London Electric	1	10	8½	24/6	—	5 14 3
do. do. 6% Pref.	1	6	6	5½	—	5 9 1
Metropolitan	1	11	8	30/-	+6d.	4 13 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 6
Midland Counties	1	5½	6	21/6	—	5 11 7
Newcastle-on-Tyne Ordinary	1	7	5	12/-	- 6d.	4 11 0
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	10½	—	5 14 3
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	7	7	28/9	+1/3	4 17 5
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	21/-	—	7 2 10
Yorkshire Elec.	1	8	8	30/-	—	5 6 8

Home Rails.

Central London Ord. Assented	Stock	4		70	—	5 14 4
Metropolitan	,,	5	8	57	—1	5 5 3
do. District	,,	3½	8½	62½	—	5 12 0
Underground Electric	£1	Nil	1½	18/6	—6d.	1 12 5
do. do. Income	Bonds	6	6	100xd	—	*6 0 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	8	10	48/9	—	4 2 0
Chili Telephone	5	5	5	7⅞	—	3 1 3
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	178½	—	*5 12 1
Globe Tel. and T. Ord.	10	10	10	18⅜	—⅛	*5 8 10
do. do. Pref.	10	6	6	11	—	5 8 1
Great Northern Tel.	10	20	20	80½	—	6 11 0
Indo-European	25	8½	10	44½	—	*5 7 6
Marconi	1	Nil	Nil	1	+1/16	.. ..
Marconi-Marine	1	7½	8½	28/9	—	6 1 9
Oriental Telephone Ord.	1	12	12	52/6	—	*4 9 4
United R. Plate Tel.	5	8	8	10½	—¼	*3 19 0
Western Telegraph	10	10	10	17⅜	—	*5 13 6

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	8 7/16	—	8 0 0
do. do. 2nd Pref.	5	6	6	8 7/16	—	8 14 6
do. do. 5% Deb.	Stock	5	5	72½	—	6 17 11
British Electric Traction Def.|Ord.	,,	8	8	500	—	... ...
do. do. 8% Pref. Ord.	,,	6	8	120½	+1	6 12 10
Brazil Traction	100	5	6	191	+5½	3 2 10
Brit. Columbia Elec. Ry. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred		6¾	6¾	181½	+1	4 15 1
do. do. Deferred	,,	8	8	161	—	*4 19 5
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/-	—6d.	Nil
London United Tram. Deb.	Stock	4	4	53½	—	7 19 5
Mexico Trams, 5% Bonds	—	5	5	72xd	—	6 19 0
Mexican Light Common	100	Nil	Nil	45½	+5	Nil
do. Pref.	100	Nil	Nil	75½	—	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	1	5	—	7/6	- 1/8	... ..

Manufacturing Companies.

Babcock & Wilcox		18	18	52/6	—	4 19 1
British Aluminium Ord.	1	12½	10	48/9	—	4 2 0
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	81 3/16	—	5 18 9
Brush Ord.	1	10	10	28/-	-9d.	7 2 10
Callenders	1	15	15	8 1/16	-1/8	4 1 7
do. 6½% Pref.	1	6¾	6½	23/9	—	5 9 5
Crompton Parkinson Pref.	1	Nil	Nil	16/-	—	... ...
Edison-Swan	4/-	10	10	10/-	-	4 0 0
do. 5% Deb.	Stock	5	5	88	—	5 18 8
Electric Construction	1	10	7½	27/6	+1/3	5 9 1
Enfield Cable Pref.	1	7½	7½	25/-	—	6 0 0
English Electric	1	Nil	Nil	10/-	- 2/6	... ...
do. do. Pref.	1	8	—	12/6	—2/6	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	7½	31/9	—	4 14 6
Henley	4/-	20	25	4 1/16	—⅛	5 1 3
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	20/-	+6d.	*5 0 0
Johnson & Phillips	1	17½	19½	48/9	—	5 2 8
Met.-Vickers Ord.	1	8	8	29/3	+6d.	5 9 5
do. Pref.	2	8	8	2⅜	—	6 14 8
Siemens Ord.	1	7	7½	29/6	—6d.	5 1 8
Telegraph Construction	12	10	10	27½	—	*4 7 4

* Dividends paid free of Income Tax.

The British Association.—I.

The 97th Annual Meeting, at Leeds.

As already announced by us, the British Association for the Advancement of Science held its meeting this year at Leeds from August 31st to September 7th. Most of the Sections, as usual, concluded their meetings on Tuesday last, but others, including Section G (Engineering), had a full agenda of papers on the following day.

Following the practice generally adopted, the Presidential Address was delivered on the evening prior to the opening of the sectional meetings, and a large attendance welcomed Sir Arthur Keith, F.R.S., who chose as his subject "Darwin's Theory of Man's Descent as it Stands To-day." A message from the Prince of Wales, as retiring President, was read, in which he, *inter alia*, thanked Sir Alfred Yarrow for his gift of £10,000 for the general purposes of the Society, to be expended within twenty years. He said that at Oxford last year he ventured to lay before the meeting a view of the relations between science and the State. He felt subsequently justified for having chosen that topic, when he observed in the proceedings of the Imperial and Colonial Conferences of the past year the extraordinary emphasis laid upon the value of scientific research in relation to Imperial development. Both conferences set up special committees on research, and the foundations of an Imperial scientific service were being firmly laid.

The most interesting sectional proceedings on September 1st, from the electrical point of view, were in Section G, where a paper was read by Prof. W. Cramp describing a hydraulic model illustrating the behaviour of the electric arc. The model was exhibited and demonstrated. We deal with the subject on another page.

Prior to this, however, there had been the reading of the Presidential Address in Section G by Prof. Sir James B. Henderson on "Invention as a Link in Scientific and Economic Progress" (which is reviewed in this issue). Sir Charles Parsons maintained that conditions in this country for the inventor were more favourable than were American conditions. A complete record of the development of an invention might deter patentees from going ahead, and he hinted that when he started his work on the turbine he might never have gone on with it had he known that some hundred patents—and some really good ones—had been taken out before he started.

Following this, came a discussion upon lubrication, opened by Dr. T. E. Stanton, of the National Physical Laboratory, who has done much work in this direction in recent years.

There was a good deal of interest in the Presidential Address by Prof. D. H. Macgregor to Section F (Economics), which was delivered on September 1st, particularly in view of the recent B.E.A.M.A. publication in defence of combines in the electrical industry (*vide* ELEC. REV., August 26th, p. 359). The address partook of the nature of a treatise on the whole problem of organising British industry in particular and industry in general upon sound economic lines.

It was announced on September 2nd that Sir William Bragg, F.R.S., had been elected President for next year's meeting at Glasgow and that the 1929 meeting would be held in South Africa. The attendance this year was about 2,600.

The greater part of the meeting of Section G (Engineering) on September 2nd was devoted to a discussion on coal. The discussion opened with signs of being an important one, but eventually dwindled away. Dr. C. H. Lander, the Director of Fuel Research to the Fuel Research Board, emphasised the need for further research into the possibilities of obtaining oil from coal, and especially pressed for fundamental research as a means for removing controversy. Dr. Lander was followed by Prof. J. W. Cobb, of the Fuel Research Department of Leeds University, who stated that the one great thing militating in practice against the replacement of the direct burning of coal, was that none of our processes of transforming coal was anything like so rapid as that of direct burning. A few others spoke in the discussion, the only point of direct electrical interest brought out being a suggestion by Dr. A. Parker, Fuel Department of Leeds University, that fuel-using industries should work in closer co-operation with the fuel-producing industries. He specially asked that gas coke in the form of breeze or dust should be utilised by the electricity supply industry for the generation of steam. Prof. F. C. Lea, Recorder of Section G, suggested that engineers should take more interest in fuel production problems and not merely accept what the colliery owners, the chemists, and those directly concerned with fuel production offered. Dr. Lander, too, in his reply, urged metallurgists to come to the rescue by providing materials for retorts which would stand up to higher temperatures, such materials, however, to be cheap.

Following the fuel discussion in Section G, Mr. J. L. Hodgson put forward a paper which was an attempt to collect the essential data and to formulate the principal difficulties bearing upon the problem of utilising the earth's internal heat, and to present them in a form convenient to engineers. The sources from which this heat was obtainable were classified under five heads, *viz.*, (1) hot surface rocks; (2) molten lavas in volcanic pipes; (3) rocks at moderate temperatures at depths of about five miles; and (4) the earth's hot central core. Of these, only the first source was at present exploited, but the second, third and fourth sources seemed, the author said, to be on the borderline of practicability.

Section A (Mathematical and Physical Science) and Section B (Chemistry) joined forces this morning for a discussion on the structure and formation of colloidal particles in the Great Hall of the University. Sir William Bragg, F.R.S., indicated the manner in which X-rays aided in the discovery of the nature of colloidal particles, and special interest was taken in the speech by Prof. H. Freundlich, of Berlin, one of the world's leading colloid chemists, who also dealt with the employment of the X-ray method of analysis.

In the course of a paper dealing with the standardisation of the fastness of dyestuffs at one of the textile sessions arranged at the meeting, Dr. S. G. Barker, of the British Research Association for the Woollen and Worsted Industries, said the first and foremost difficulty experienced in testing the fastness of colour of dyestuffs was that no standard source of daylight was available for comparative tests to be made. Such a standard source of light should approximate in properties as closely to daylight as possible, and must be reproducible and constant over long periods both as to quality and quantity of light. As the result of tests carried out in the laboratories of the Woollen and Worsted Research Association, the conclusion had been reached that the violet carbon arc was the best for testing the fading of dyestuffs. The staff of the Association had devised such a lamp, which was being manufactured by Messrs. Kelvin, Bottomley and Baird, and it was known as the "Fugitometer." An experimental lamp had been delivered for testing and would shortly be on the market.

Switchgear for Alternating Current.

By H. W. CLOTHIER, M.I.E.E.

(Abstract of Paper read before Section G.—Engineering.)

ALTERNATING-current switchgear as known to-day is the outcome of the work of a few pioneers. The earliest stages are associated with such names as Crompton, Mordey, Raworth, Lowrie-Hall, Ferranti, and Partridge. Dr. Ferranti in particular conceived and put into practice ideas for large plant, high voltage, and long transmission distance, comparing not unfavourably in magnitude with those commonly in use in this country to-day. The whole of the science and industry of switchgear has grown up within the lives of engineers who are still active.

There is a clear-cut distinction between Continental, American, and British switchgear for normal power-station work. Continental gear is generally light, with somewhat scanty protection; but American policy has taken its power-station switchgear to extremes in protection. British designs on the whole lead to still stronger circuit-breakers. They tend to reduce expenditure on buildings by making the switchgear take a complete unit form, entirely contained within a strong metal enclosure. Thanks to this construction, none but earthed

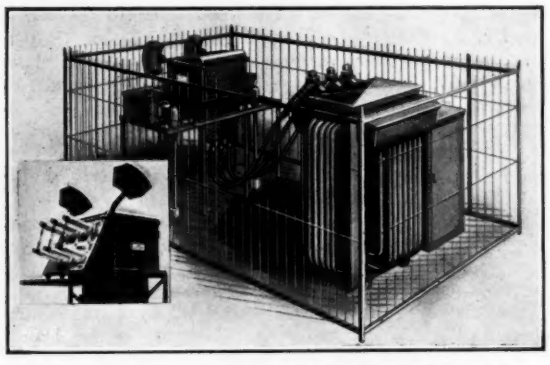


Fig. 1.—An Outdoor Sub-station with a Minimum of Metal-clad Components.

metal can be touched and risks of fatal shock are minimised. A broad view of the relative positions of British and American designs to-day shows that while we are extending the use of labour-saving automatic and central control of plant, the Americans are paying more attention to the saving in space and avoidance of life risks which we have secured by metal-clad construction. In respect of dimensions of plant we are following in their trail, but they admit that in systems for the protection of plant and the maintenance of a continuous supply their differential timing devices for "selective isolation of faults have not proved sufficiently flexible to maintain the maximum integrity of such systems." This leads to a strong trend towards the use of balanced relay systems of the Merz-Price and other kinds, which are of long standing in British practice. It is possible that they have set too much store upon the periodical testing of cables and the like by high pressures as a means of discovering weakness before the occurrence of faults, while we have on the whole left the testing alone and have endeavoured to equip our gear so that it will isolate faults instantaneously without interruption of supply. Both methods have their bad features.

It would appear to be almost universal in Britain and America to stiffen up the construction of circuit breakers, either by very strong exterior tanks, or by the use of so-called "explosion pots" immediately surrounding the arcing contacts. The paper indicates some of the problems, and the lines on which they are being or may be solved, as an avenue to a forecast of the future.

Insulation.

The study of insulating materials has of necessity been first directed to the low-pressure qualities, which include basic fibrous and mineral materials and insulating preparations; this has proved helpful in strengthening the trend towards unification of design, methods of testing, and purchasing. It is now necessary to ascertain the limits of the uses to which materials at present available may be put, including the safe margin of strength to be allowed under given conditions for different materials designed to withstand a given test pressure and service voltage; and to standardise the degree of dielectric strength required in insulators to provide adequate security for given service conditions and supply pressures.

Fulfilment of these requirements would perhaps bring us nearer to the discovery of the ideal material, which would have to be tough, inert, and homogeneous, and capable of being made with electric stress control characteristics and of retaining its dielectric and physical properties unimpaired under widely varying conditions of service. The importance to switchgear of oil and insulating materials is such that continual vigilance is necessary to ensure that the quality of supplies is maintained at a high level. Photomicrographs are of considerable assistance in determining the quality of such products as bakelised paper and porcelain, which are two of the most important solid insulating materials used in switchgear manufacture.

Switchgear, particularly when it is used out of doors, should be capable of operating correctly and without risk of breakdown under extreme conditions both of cold and of heat. The need for oil with a very low freezing-point is noticeably increasing, and the latest British Standard Specification provides for oils with solidifying points as low as −30 deg. C. The viscosity of oil increases very rapidly as the temperature is lowered, and if it becomes unduly viscous there is a tendency to retard the action of the circuit-breaker when opening under short-circuit conditions. To meet the demand for compound-filled metal-clad draw-out switchgear for use in very cold situations, a low-freezing-point compound has also been developed, having characteristics generally similar to those of the material already used in normal circumstances, but still comparatively ductile and without any tendency to crack at a temperature of −30 deg. C. The difficulties arising in hot situations have to be provided against equally carefully. No special trouble is encountered with oil unless oil-tight joints are required; but this involves problems of design rather than of materials. Compound for hot situations must have a high melting-point so that there is no danger of its becoming fluid enough to run out at the joints, and it is now possible to obtain several grades with suitable characteristics. Under variable atmospheric conditions insulating oil may absorb moisture, and may thus have its electric strength lowered. As a matter of ordinary routine, oil from switch and transformer tanks has to be dehydrated and purified periodically, and an interesting piece of special apparatus has recently been devised, to subject oil undergoing this process to a continuous pressure test while it is flowing from the drying machine to the storage tank. As long as the dielectric quality of the oil remains good, it is allowed to pass unhindered; but if there is any breakdown a warning bell rings and the oil is automatically diverted and prevented from entering the tank.

The limitation in the use of the principle of complete enclosure is found in the cable. If the conductors leading to the switchgear are not metal-clad, as happens in a cable, the system is incomplete. The highest voltages for which metal-clad switchgear has been made are 50,000 and 66,000 V; but with progress in cable construction, such as may be seen, for example, in the 132,000-V grade now in hand and required for the "grid," the complete enclosure of the entire system will be attainable.

Relief to Operators.

The growth of plant and interconnections calls for the greater development of means of relieving the operator of the necessity of making vital decisions at critical moments. Amongst these may be included: Mechanical interlocking to ensure none but a correct or harmless sequence of operations; centralised control of all plant in a quiet room remote from plant actually running; and the extension of the principles

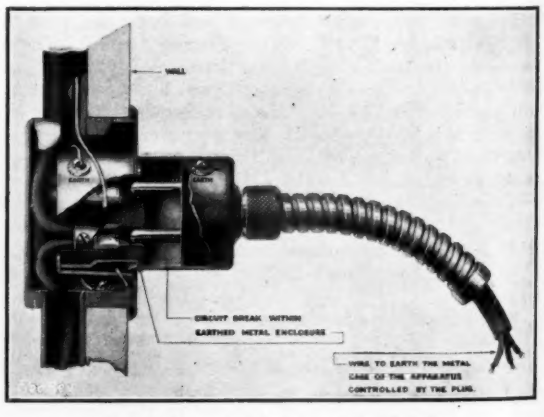


Fig. 2.—A Standard Switch and Earthing Plug.

of the control-room in generating stations to the control of outlying sub-stations; automatic synchronising of generating plant; the perfecting of the known balanced systems of protection in order to ensure absolute consistency and discrimination in operation, and the elimination of interference by high-frequency capacity currents in primary cables, which has been accomplished by the use of surge-proof relays designed to operate only at normal frequency. The automatic isolation of a faulty section or plant without interference with the working of all the sound sections is the first essential for continuity of supply; the safeguarding of plant from failure due to overload, by means of temperature indication by alarm devices so arranged as: to ring when certain predetermined limits are reached, to cut in stand-by plant to give relief in the load, or actually to cut out the plant as an extreme measure if the excess temperature is such as to lead to danger of breakdown; the removal of danger of shock; the great essential for safety is that there shall be no accessible metal which is not properly earthed.

The Breaking Capacity of Circuit-Breakers.

The ability of a circuit-breaker to make on a short-circuit is at least as important as its ability to break on a short-circuit; the making capacity should never be less than the breaking capacity. A standard method of rating both breaking and making capacity is now being considered by the B.E.S.A., and it is expected that a revised specification for oil-immersed circuit-breakers will be issued shortly. The research carried out by the British Electrical and Allied Industries' Research Association on the breaking capacities of oil-break circuit-breakers included fundamental studies of the multitudinous variables, but the information so far published*

Fig. 3.—Switchgear of Intermediate Size.

only goes to prove how difficult it is to obtain precise limits to the stresses set up within circuit-breaker enclosures even when repeated openings take place under the same conditions of overload. The existing plant available for tests is large enough for small industrial circuit-breakers, but for tests of switchgear on transmission and generating-station service it is becoming urgent that the research shall be continued on plant of at least ten times the output. Another requirement is a simple apparatus to measure and record the short-circuits experienced in actual service.

Metal-Clad Auxiliary Apparatus.

The enclosure of auxiliary fuses and contacts in metal-clad construction introduces the problem of satisfactorily disposing of the arc gases generated on the rupturing of the fuse or the separation of the contacts. If allowed to remain within the enclosure, they are conducive to further arcing because of the lowered resistance of the clearances and insulating surfaces. For fuses the problem has been met by completely sealing them up in cartridges which will not yield to the mechanical stresses set up inside them. In a contactor switch for controlling solenoid currents, an air blast has been applied to the arc, forcing the gases harmlessly out of the enclosure. This makes the customary magnetic blow-out coil unnecessary, and simplifies the construction.

Measurement of Currents.

One of the problems incidental to the introduction of high supply pressures, such as those of 66,000 volts and upwards, with consequent low values of primary currents for the largest amounts of energy, is the need for very sensitive metering.

* See the paper recently read before the Institution of Electrical Engineers by Messrs. Wedmore, Whitney and Bruce.

A system of instruments has been developed† to use a secondary current of half an ampère; these are equal in accuracy to those used on lower voltages, in which hitherto a secondary current of 5 A has been the standard. The same principle is applied also to the operation of relays for overload protection.

Economy.

Everywhere endeavours are made to produce cheaper control switchgear. So long as these are exerted towards eliminating dispensable switches and other control apparatus, they are healthy; but if they also lead to a lowering of quality in the units that remain, they are retrograde. The use is growing of kiosks containing high-pressure connections and transformers for sub-stations, in which there are bare terminals, isolating switches, and other dangerously exposed conductors. If it can be ensured that the interior will not be accessible while it is alive, a metal kiosk used as a covering possesses to some extent the recommended metal-clad features; but the practice seems to be developing in such a way as to lead to the inclusion of a complicated mesh of change-over devices for alternative connections. It is preferable to use the absolute minimum of entirely metal-clad components, erected in the open air, and surrounded only by a fence sufficient to prevent interference by children. Fig. 1 illustrates an outdoor sub-station of this description, in which protection against overload is given by the use of an oil-immersed switch-fuse, a device containing a spring-loaded fuse in a steel box. The fuse is mounted on the hinged steel lid of the box, which can be opened for purposes of inspection and isolation. From the manufacturers' point of view, bulk production is an essential for economy; but the demands have been so variable that one rarely meets a manufacturer fortunate enough to have had experience of it. Users must settle down to standard methods of control before long, and when that time comes a higher quality may be achieved with economy of cost as a result of bulk production.

The Draw-Out Feature.

A salient point in the design of metal-clad switchgear is the draw-out feature, that is, the plug principle of construction. The orifice chambers at the points of juncture between the fixed portion and the removable portion contain the only conductors capable of being made accessible; and that happens only when the two portions are separated. It is only the fixed portion that can be alive, and the conductors on that side are therefore deeply recessed so as to render accidental access practically impossible. The problem of making these conductors and insulators safer has been solved in gear for some of the largest power stations by a vertical draw-out of the removable portion, which leaves the fixed contacts and insulators in a container of oil. The fundamentals for safety in all electrical plant and devices are: Complete enclosure of all conductors when alive; effective earthing of all accessible metal which may otherwise be alive by accident; and easy and safe means of isolation of moving parts for inspection and maintenance.

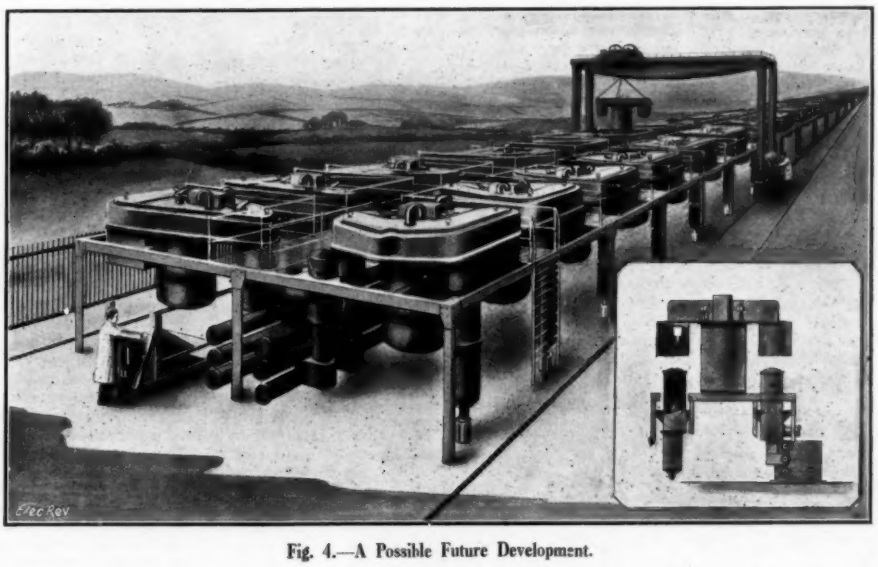


Fig. 4.—A Possible Future Development.

In the home, as in the factory, the control apparatus will provide means for earthing the cases of radiators, lamp standards, and all portable power-using appliances. While the usual domestic switch is required for the remote control of lights from the neighbourhood of a door, a more complete means of earthing and isolating is available in the plug and socket for the control of portable appliances. Fig. 2 illustrates a standard plug fitting made to a recent B.E.S.A. specification.

† By Messrs. Reyrolle & Co. and Messrs. Nalder Bros. and Thompson.

As a circuit-breaker for moderate currents, this is more effective than the usual tumbler switch, and since it provides a good earthing system as well, it may turn out to be the simplest form of control in future installations where economy consistent with safety is the primary consideration.

Switchgear of an intermediate size suitable for many applications in power stations, in industry, and elsewhere, is illustrated in fig. 3. It is typical of many varieties, some of which are adapted by their flame-proof construction for service underground in mines and in other places where there is risk of fire or explosion. The extending use of switchgear of this type is one of the surest tokens of increasing safety and effectiveness in the future employment of electricity for all purposes.

At the other extreme from the domestic plug, there is the largest power-station control gear. Following the present tendency, it will consist of large and strong steel enclosures with conductors and insulators immersed in liquid in preference to compound on account of the heavy currents to be carried and the need for cooling by convection. If oil is used, the risk of fire on a large scale will be reduced by placing the gear out-of-doors. The paper includes an illustration of a construction of this kind now in experimental service in Bradford, which was reproduced in the ELECTRICAL REVIEW of July 22nd (p. 134). Fig. 5 shows a possible development of the type as it might be applied in the future to a large super-power station. The entire circuit-breaker is the removable portion. It will be raised as a whole by a crane or a truck for inspection and adjustment, when these become necessary after it has opened on a short-circuit. If two alternative sets of bus-bars are used, the change-over from one to the other will be effected by lifting the removable portion clear of the isolating contacts, giving it a turn through a suitable angle, and then lowering it into its new position. The design must be such as to comply with the fundamental requirement that all the conductors shall be metal-clad and immersed when alive. Further, in switchgear of this type each phase must be separately housed by the metal framework; and the large metal-clad gear already working at Dalmarnock, Barking, and other similar power stations is actually constructed on these lines. In addition, the arrangement now illustrated is such that there is no place where conductors at the potential of one set of bus-bars are contained in the same chamber as conductors connected to the other set of bus-bars; in other words, the bus-bars and the individual phases are completely surrounded by enclosures of the earthed metal type.

The call of economy is unrelenting. But economy is not only required in the initial cost; it must equally be secured in maintenance and running costs, and in the elimination of housing, of expensive protection against fire and other hazards, and of risks to life. The mechanical construction of the moving parts, the tripping mechanism, and the weatherproof qualities of switchgear are becoming more and more perfect as a result of lengthening experience in the design and manufacture of both indoor and outdoor types, so that the future should see a stage of development in these directions that will give practically entire immunity from mechanical failure. Complete immersion in oil protects the insulation, and research will lead to a perfect understanding of the exact clearances and other features required under the practically stable condition of oil immersion. The case is entirely different for conductors and insulators exposed in air, because the dielectric properties of air are changeable, and this variability in the insulating value of the air clearances, together with the access of dirt and other extraneous interference, is always apt to weaken the insulation and thus to lead to breakdown. But there must be no breakdown of gear which is itself to be a protection against breakdown and interruption of supply; and the bus-bars, the current transformers, and all the component parts of the gear, including the insulators and the conductors of the circuit-breaker itself, must be enclosed for protection against the elements. It is by working along the lines that have been indicated throughout this paper that security of life and property, as well as safety, simplicity, and continuity of operation, will most certainly be insured.

The author acknowledges the co-operation of his company, Messrs. A. Reyrolle & Co., Ltd., and assistance in compiling the brief paper from members of its staff, in particular Messrs. Leeson, Allan, Carter, and Peel.

Invention as a Link in Scientific and Economic Progress.

(Review of the Presidential Address to Section G.—Engineering, by PROF. SIR JAMES B. HENDERSON.)

AT the outset of his address the author attempted to differentiate between discovery and invention and, broadly, defined the former as theoretical and invention as practical. Discovery had to be proved and invention reduced to practice. The history of great inventions was very complex. Wireless telegraphy and telephony, for instance, were not the work of a day or of one person; many contributed to their development, by way of discovery and invention, and finance furthered their progress. In the last respect the commercial interests represented by Marconi had an advantage over the Admiralty, which was restricted by a limited Budget allowance for research.

Invention was a historical science; it was actually concerned less with the scientific principles of physics than with the human element, with limitations which that element imposed, with peculiar conditions under which the forces of nature had to be applied and with the unknown elements in physical science. Unlike other historical sciences, however, invention was handicapped by the lack of records of the technical difficulties which had been encountered, and the new searcher had generally to start afresh. Inventors would gain much if they could be made aware of the difficulties of the past. Useful experience in developing the inventions of an industry often died with the individuals possessing it, with the result that much time was lost by future workers having to pass through the same experience to regain the lost knowledge. That retarded progress and resulted in financial loss. An invention having been made a commercial article, should not be put on the market until all possible defects had been remedied. Much of the success of the great inventions of history had been due to a happy combination of inventor and promoter; absence of that combination must lead to delays in development and the impairment of success. Invention was the heart of industry, the root of new developments, and the source of improved methods of production, and although many industries had instituted valuable research departments, it might be asked whether this country was doing its best to stimulate invention as a means to foster industry. The author then proceeded to trace the links between the physicist, the chemist, and the engineer, and said that the closer this intercourse became the greater would be the fertility in invention, and the faster the economic progress. The physicist working continually in a laboratory was apt to forget how artificial his working conditions were, and that before his experiments could have a practical application to industry a great deal of invention was required. Dealing with the patent system, Sir James Henderson considered that distinction should be made between inventions that were complete and could be easily developed and those which were of greater importance and needed experience before they could be perfected. In the United States it was possible for an applicant, by filing periodical amendments of his specification, to keep the application pending for a number of years, during which period he could be developing the invention and adding to the specification any further explanations which might be called for in the light of the experience gained. Then when the patent was eventually issued it ran for 17 years from the date of issue, whereas a British patent dated from the time of application. The American system had its disadvantages, but it afforded a means of discriminating between the two classes of invention mentioned. In this country there was a possible solution in an extension of the present system of granting patents of addition: that was a patent for an improvement on a prior patented invention, the patent of addition being granted during the life of the patent and running coterminously. If a patent of addition could be granted to an inventor in approved cases, on production of evidence of genuine difficulties encountered and successfully overcome, those difficulties and their remedies being described in the patent for future guidance, and if the patent of addition could be made valid for a definite term of years, one of the main fears of a patentee would be overcome. The system would also afford a means to prevent future inventors and industry from being handicapped by the beforementioned lack of records of past difficulties. In concluding his address, the author suggested that the Association and kindred bodies should compile with the aid of inventors, and publish, a brief description of the main historical features of inventions. The publication should take account not only of the successes, but also of the failures. Many of the so-called failures of yesterday might only be waiting for other hands to-day to carry them to a greater success than the world had ever known.

Transport on the Farm.

By R. BORLASE MATTHEWS, M.I.E.E., &c.

(Abstract of Paper read before Section "G."—Engineering.)

AGRICULTURE has now arrived at the stage where the problem of the introduction of considerably more machinery and the electric power to operate it must inevitably be faced. Farming has seriously lagged behind all other industries in the use of power—particularly of electric power. Many farm duties are carried out just as they were one hundred years ago.

A large proportion of the cost of hay and corn, especially that fed on the farm itself, is accounted for by the high labour costs involved in the handling of the material. Only too frequently hay is carried in single trusses on the shoulders of a man from the rick yard to the barn; this alone nearly doubles the cost. Then with the grain crop, for instance, there is the pitching of the sheaves from man to man, then on to the thresher, and afterwards the hauling away and distribution of the grain, straw and chaff, respectively. All this work could be performed more efficiently and speedily and at lower cost by the aid of mechanical equipment, preferably electrically operated.

In the field the hay should be windrowed and by means of a hay loader (hauled after the wagon) lifted on to the vehicle. This method is used by the author. A portable folding hay elevator for building stacks is often seen, and while this elevator is a step in the right direction, it still

requires man labour to fork the load on to it from the wagon. A great improvement in the method of handling a crop is to utilise specially prepared slings or automatic grapple forks in place of the elevators. The sling method is by far the better. With one method the slings are placed in the empty wagon, which is to be used for carrying the crop from the field; when the vehicle is loaded, the sling is fastened over the load, and, on arrival at its destination, the whole load is lifted in one operation. Then, on arrival at the barn, the whole load is lifted and taken into the barn in one operation by means of an overhead run-way on the "Temperley" transporter principle operated by an electrically-driven winch. A from three- to five-horse-power motor is large enough to drive the winch. Any subsequent re-distribution of the crop can be made by the aid of automatic grapple forks, which can also be used for feeding on to electrically-driven conveyors which deliver the crop to the final point. The "Temperley" type transporter is operated by an electrically-driven hoisting gear, provided with two hoisting drums and two sets of brakes. This gear is conveniently located near the unloading point, thus giving complete control to the man in charge.

Endless belts about twelve inches or so in width, mounted on a suitable frame and mechanically driven, are very useful for loading roots, stones or other materials. The frame carrying the belting is inclined at such an angle that grips or buckets are not needed on the surface of the belt. The whole arrangement is generally mounted on wheels, of large diameter, to facilitate lifting it about.

Electrically driven portable chain conveyors should be employed to transport the sheaves from the rick yard or barns to the thrashing machine. An automatic device should be incorporated on the thrashing machine for cutting the bands on the sheaves and spreading out each sheaf before delivering it on to the thrashing drum. With the introduction of mechanical delivery devices the thrashing machine can be permanently mounted on foundations at about four feet above the floor level, thus leaving ample room for bagging, &c., when required. The straw can be delivered on to a horizontal conveyor. The grain can be moved either by Jacob's ladders (buckets mounted on endless belts) or special worm conveyors which deliver the grain on to horizontal or inclined belt type conveyors, direct to the granary. Another method is to employ pneumatic delivery tubes which can be as much as 200 yards in length. A 5-h.p. motor-driven fan can carry grain or straw for a distance of 50 yards, whereas an 8-h.p. motor may well double the distance, and a 10-h.p. size will carry 200 yards. Most of the conveyors described are of extremely simple construction, hence the capital cost is not great. Where new farm buildings are being erected and it is intended to use these modern mechanical improvements, special provision should be made in arranging the buildings. In Fifeshire, one of the first uses made of electricity on those farms connected to an electric power supply was the handling of the output of the threshing machine by mechanical means. By many ingenious contrivances the Scotch barns, which are nearly all low-roofed buildings and apparently quite unsuitable, were equipped with elevators and conveyors. When threshing machines are equipped in this way, only one or two attendants are required on the machine. Another man will attend to the feeding of the conveyors in the rick yard, and another will look after the straw yard or barn.

The cleaning of byres and stables is probably one of the most disagreeable and heaviest of all farm tasks, yet one of the most important. The introduction of a mechanical overhead manure carrier means a great saving in the time and a lightening of the work. These overhead conveyors generally consist of an overhead track, of a cruciform section. This rail is very ingeniously suspended by light standardised link hanger fittings from the roof or from special metal or wood standard supports. To deliver to a wide manure heap a radial track is often utilised, or a very light equivalent of the engineers' travelling crane. The author has designed a very simple type of overhead rope runway for his own farm.

In New Zealand it is a common practice to convey the milk as it is drawn from the cow by a milking machine, direct to the cooler in the dairy, through tinned pipes. This saves all handling and carrying of buckets. When a cow-house is fitted with modern electro-mechanical equipment, it is possible for three men to attend to, clean and milk 150 cows. This compares very favourably with the accepted trade union rate, under ordinary conditions, of ten cows per man.

The system of manuring of fruit farms by using stand-pipes in the orchards was first carried out in Switzerland some years ago. The stand pipes are connected to a manure tank, adjoining the main cow byres, by means of underground pipes. A force pump, taking its supply from the tank, pumps the mixture through the pipes to the orchard, where it is distributed by means of a hose pipe and nozzle.

While the introduction of light railways may seem a big step forward in our present methods of agriculture, nevertheless, consideration of the possibilities, especially in view of the fact that light railways are now used on a number of European and Colonial farms, might provide a useful discussion. Continental experience seems to show that a number of the large better-class dairy farms might well be equipped with light railways radiating from the buildings to some of the fields. These railways can be operated by horses, oil or electric power. In Denmark light railways are run from the fields alongside the country roads to the sugar beet factories. These are generally equipped and operated by the factory proprietors.

A consideration of the tonnage required to be moved per acre and an analysis of the output of a large dairy farm should be considered when studying this problem. The transport of milk produced also presents a formidable task. There is clearly considerable scope for a very large increase in the milk supply. The introduction of mechanical labour-saving devices will lower the cost of production, and at the same time, ensure a cleaner supply of milk, which will increase the demand, as a cheaper grade of good milk will be available.

The question of transport and the introduction of electro-mechanical appliances for all the farm buildings is relatively simple, if farming is carried on on modern lines, as then the power demand would be so great that the supply undertakings would be anxious to cultivate the rural load.

A Hydraulic Model of the Electric Discharge.

(*Notes on an Exhibit by* Prof. W. CRAMP *in Section G.*)

The electric discharge, whether in the form of a spark, the current through a neon tube, an ordinary arc, or a "Pointolite" lamp, has one characteristic which distinguishes it from conduction of other currents. No current passes across the arc until a certain maximum pressure has been reached, but after this the current can be maintained by a very much lower p.d. In some cases, the slope of the p.d.-current characteristic is negative; in other, as, for instance, the neon tube, it is positive. Special forms of discharge, such as the Poulsen arc, have a characteristic intermediate between that of the neon lamp and that of the ordinary arc. The fact that the discharge p.d. may be much lower after the current has once begun than at the time of breakdown, enables the discharge, in its various forms, to produce surges and oscillations, provided that the appropriate apparatus, such as resistances, condensers and inductances are included in the circuit. Since in a circuit consisting of a tube containing liquid the resistance may be represented to some extent by fluid friction, inductance by mass, and capacity by a store of fluid, it follows that, if such a tube can be provided with apparatus which will allow of the free escape of liquid when a certain pressure is reached, and with a continuation of that escape at a lower pressure afterwards, the condition of the electrical discharge circuit may be imitated. Such an arrangement entails the use of a valve, which will open at a predetermined pressure and remain open until a lower pressure has been reached. This is not easy to provide by mechanical means. It may, however, be easily obtained by making use of the phenomena of surface tension. If a siphon tube is made of gradually increasing diameter, the potential energy of the meniscus diminishes as the diameter increases, and consequently there will be a tendency for the meniscus to contract against the gravitational force of the fluid in the tube. If, therefore, the amount of fluid in the tube increases, the meniscus expands until a certain limit is reached, when it allows fluid to escape. Such an arrangement forms a very perfect automatic valve for the purpose of a model to imitate the electric discharge. (A model of this nature was shown.) It is possible to imitate the production of electric oscillations by the quenched spark, the behaviour of the neon lamp when fed from a constant pressure circuit with a resistance in series and condenser in shunt, and the behaviour of certain phases of the Poulsen arc.

Discussion.

In a brief discussion which followed the demonstration, Prof. G. W. O. HOWE said that hydraulic analogies were always useful in teaching students electrical phenomena. An interesting point in connection with the paper was the distinction between the Duddell arc and the Poulsen arc. That subject had not been treated in any English papers, but it had been dealt with fully in German papers by Pedersen, of the Poulsen Co. Pedersen had published numerous papers dealing with cathode-ray oscillograms, but while he referred to the striking voltage or the extinction voltage, he did not mention the negative resistance or falling characteristic. He (the speaker) had always regarded the subject as being divided into two separate phenomena: the Duddell arc, with its non-extinguishing oscillation which he had always regarded as being due to the falling characteristic, and the Poulsen arc, which worked under conditions where it was extinguished at each oscillation. Prof. Cramp had rather dealt with the two phenomena as two aspects of one common phenomenon.

Prof. E. W. MARCHANT agreed with the latter view expressed by Prof. Howe, and at the same time remarked that Prof. Cramp's model was a much simpler one than that used by Duddell for showing the oscillatory arc.

Prof. CRAMP said that if Professors Howe and Marchant could show him how by means of direct electrical pressure and a falling characteristic it was possible to transfer energy from the direct to the alternating side, he would be only too pleased to learn. He did not see how it could be done without a hysteresis loop. The difficulty in analysing the problem mathematically, which he had done, was the discontinuity of the equations. It had to be taken in three sections, and it was only possible to get an approximate result.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Novel Lift.

In our large cities and towns the one-floor garage is nowadays not a commercial proposition, and it is necessary to make use of basements and upper floors. The "Turn-Lift," fig. 1, a recent production of Messrs. WM. WADSWORTH AND SONS, LTD., 11, Queen Victoria Street, London, E.C.4, and a patented design of Mr. E. Chaudoir, offers a novel scheme for garaging cars. The lift is arranged in cylindrical form; it can be turned and its entrance arranged so that a car can be picked up from almost any direction. Surrounding the lift proper on each floor is a steel structure, usually in the form of a cylinder, which revolves and serves a number of cubicles which radiate from the lift well. The cylinder has only one door, so that doors for the actual cubicles are unnecessary. The lift cannot be moved either vertically or laterally until all the doors are closed, *i.e.*, the actual lift door and those of the revolving cylinders on the various floors. The advantages offered over the one-floor garage by the one-cubicle-one-car principle are obvious. It is claimed

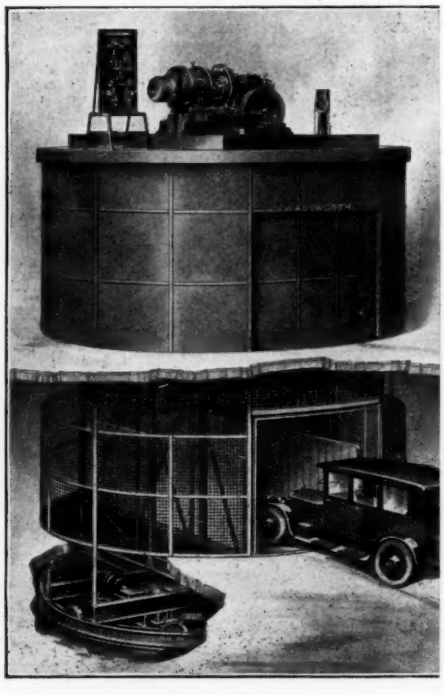


Fig. 1.—The "Turnlift."

that a "Turn-Lift" costs only about 10 per cent. more than an ordinary fixed lift. The lift is particularly recommended from a space-economy point of view, for installation in buildings with a floor-area per storey of about 3,400 sq. ft. Such a building with five floors will, it is claimed, accommodate 55 average-sized cars. The whole apparatus is for reasons of efficiency and economy electrically driven and operated.

A Bed-Warmer Regulator.

We have received the following particulars of a Swiss bed-warmer regulator which has brought happiness to a correspondent after a number of failures with other types of apparatus and much expenditure for burnt bedding. The thermo

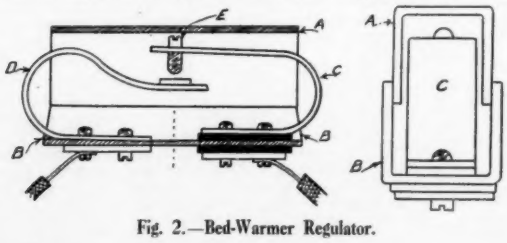


Fig. 2.—Bed-Warmer Regulator.

regulator, fig. 2, consists of two bi-metallic bent strips C and D housed in a flattened cylinder, made in two parts, A and B. The latter portions are held together by friction only, the channel-shaped piece A being forcibly pushed into the jaws of the similarly shaped piece B. The strip C is insulated from the

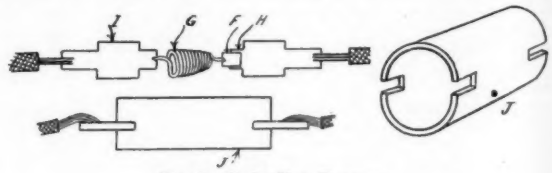


Fig. 3.—Spring-Fuse Protector.

housing, but D is in metallic connection therewith. The electric circuit to be controlled is made through the springs by attaching one wire to the body of the apparatus and the other to strip C, the final connection being made by an adjustable screw E by which the temperature may be regulated to within a few degrees. The regulator is embedded in the centre of the bed-warmer and its housing allows of fairly rough usage of the heater without affecting the regulation. As a further protection against heat or possible short-circuit a very ingenious form of spring-fuse, fig. 3, is used. In this the circuit is made to pass from a plate I to a plate H through a spring G and a small auxiliary plate F. F is attached to H by means of a very fusible solder. The cut-out is enshrouded by a small earthenware tube J, which is of such length as to impose a strain on spring G and thereby give a rapid opening of the circuit when the fusible metal melts.

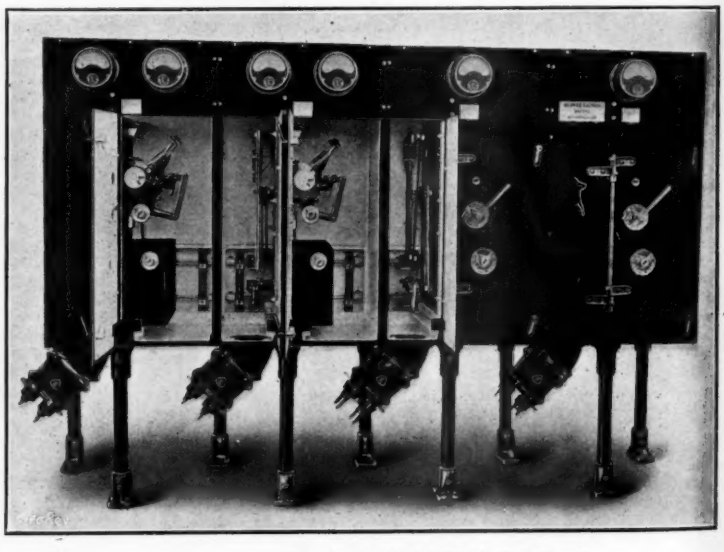


Fig. 4.—Sheet-steel Cubicle Switchboard.

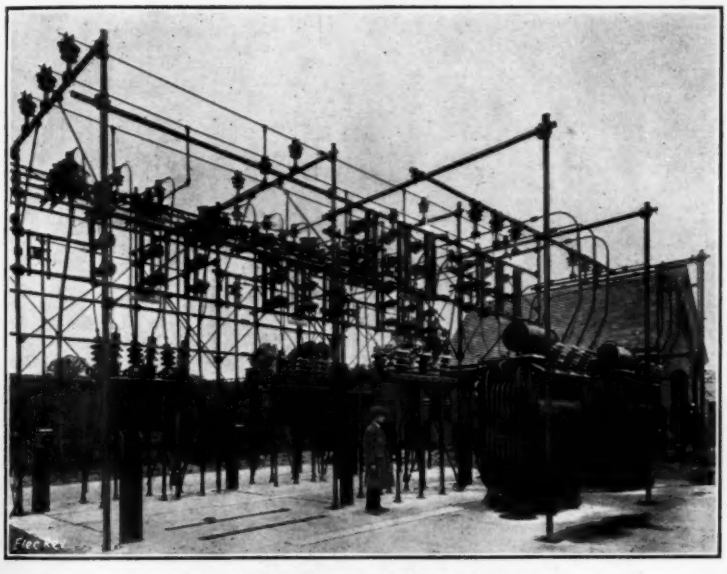
New D.C. Switchgear.

To meet the demand for metal-clad heavy-current d.c. switchgear of high breaking capacity, Mr. GEORGE ELLISON, Perry Barr, Birmingham, has developed a sheet-steel unit containing standard Ellison circuit breakers, isolators, busbars, and complete interlocking safeguards. It is quite self-contained with the necessary indicating instruments and devices for connecting up and sealing the cables, and any number of units can be erected together in the form of a switchboard, fig. 4, with links to couple up the busbars. Easy access to the component parts is arranged by means of hinged doors, which can be swung open when the breakers and isolators are "off." The isolator contacts are shielded so that absolute safety is assured for an attendant inspecting the gear. The cable terminals are in a convenient position for connecting up and the sealing boxes are disposed at an angle to obviate sharp bends, while the cubicle supporting members are designed to facilitate "laying" the cables, avoiding having to push stiff armoured cables through holes in castings. Orders which have been completed for colliery and industrial applications indicate that this new type of d.c. switchgear will be popular.

33-kV Outdoor Sub-stations.

Ferguson, Pailin Switchgear on the North Metropolitan Electric Power Supply Co.'s System.

FOLLOWING on the erection of extension equipment at the main Brimsdown outdoor sub-station of the North Metropolitan Electric Power Supply Co.'s system*, Messrs. Ferguson, Pailin, Ltd., have installed 33-kV outdoor sub-stations at Cuffley, Hertford, Buntingford, and Royston, to the specification of the chief engineer, Capt. J. M. Donaldson, M.C., M.I.E.E. The Cuffley sub-station is fed from Brimsdown and connected by a 0.1 sq.in. feeder to the existing 33-kV radial feeder to Hitchin, at Potter's Bar, thus forming a ring system through Barnet back to Brimsdown. A second 0.1 sq. in. radial feeder commencing at Cuffley feeds in turn Hertford, Buntingford, and Royston, where the feeder is extended to embrace the Shepreth and Sawston outdoor sub-stations of the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Company, the switchgear for which has also been manufactured by Messrs. Ferguson, Pailin, Ltd.



The 33,000-volt Sub-station at Cuffley.

At both Cuffley and Royston two 500-kVA, 33,000/3,000-volt transformer banks supply local needs, whilst at Hertford and Buntingford local transmission is at 11,000 volts through one 3,000-kVA and two 250-kVA transformer banks respectively. At Hertford the oil-immersed circuit breakers are electrically remotely controlled, but at the remaining three stations they are directly operated. The whole of the gear has been designed and specially finished to withstand atmospheric conditions. The switchgear is mounted on self-supporting pipe framework embedded in concrete as shown herewith, and inverted-pattern feeder trifurcating boxes located on the framework are designed to receive bare copper connections from the switchgear terminals, and lead away 3-core armoured cables which, in the main, terminate in similar boxes on the transmission towers. The type "Ua" circuit breakers are rated at 300 amperes, each comprising three single-pole units, the solenoid mechanism incorporating a device to prevent "pumping." Bakelite bushings are employed, the exterior portion being shrouded by porcelain insulators to prevent the voltage "spilling" under the action of rain and sleet. Self-contained tank-raising and lowering mechanism facilitates inspection of the finger-pattern contacts, and each breaker is frame mounted, thus elevating the live terminals to comply with the H.O. requirements.

The incoming and outgoing feeder equipments are provided with both busbar- and line-isolating switches, whilst the transformer equipments are provided with busbar-isolating switches only; the line-isolating switches are provided with earthing contacts. In both cases these switches are of the 3-pole pattern arranged for remote hand-wheel operation at ground level. Means are provided to prevent the switch blades from swinging back into the "on" position during high winds, and unauthorised operation is prevented by a locking "on" and "off" attachment. To ensure that a feeder is dead before work can be carried out, an earthing device has been so designed that the centre phase is earthed immediately before the remaining phases are earthed. The earthing switch, also operated by a separate hand-wheel, is interlocked with the isolator so that (*a*) it can only be closed when the main switch is open, and (*b*) it is impossible to close the main switch while the earthing switch is closed.

The pin insulators are standard 44-kV units, each consisting of several brown glazed-vitrified-porcelain shells cemented together and provided with a drilled metal cap and a flanged steel fixing bracket. All the connections are tubes with solderless connectors, coloured so that the phases are readily distinguishable. The framework is connected by copper strip to earth plates.

The incoming and outgoing feeders are equipped with opposed-e.m.f. protective gear, the relays being energised through biasing transformers from the bushing-type protective transformers mounted on the oil circuit-breaker bushings. Certain feeders are provided with additional induction definite minimum inverse time-limit overhead relays. The protective relays are of the double-pole pattern with line and earth fault elements contained within one case; they are designed to be immune from operation due to the occurrence of frequencies other than the supply frequency of this particular system. Except at Hertford, where the transformer bank is provided with B.T.-H. overload and leakage relays, the transformer banks are fitted with three direct-acting overload trip coils energised from bushing-type current transformers, and with shunt trip coils having controlling switches interlocked to ensure the simultaneous tripping of both primary and secondary oil circuit breakers.

The metering equipment located on the Shepreth feeder comprises two F.P. multi-turn primary compound-filled current transformers, two single-phase oil-immersed potential transformers (ratio 33,000-110 volts) with single-pole hook-operated isolators, and an indoor metering panel accommodating two polyphase unbalanced-load "Sangamo" watthour-meters with a meter test-link box.

The control panels accommodate an "Ideal" ammeter for each feeder circuit, together with red and green lamps to indicate the "on" and "off" positions of each breaker. All breakers are remotely tripped by push buttons, except at the Hertford station, where the closing and opening operations are carried out by means of a control switch. The multi-core cables running to the e.h.p. switchgear can be readily disconnected at the switchgear end by means of special links located in the sealing boxes.

* See ELEC. REV., October 1st, 1926, p. 527.

American Radio-Valve Developments.

Some details of new "Radiotrons" which should make the realisation of a completely a.c.-operated radio-telephone broadcast receiving set more easily attainable: the filament of this type of thermionic valve may be energised directly from the domestic electricity mains by means of a suitable transformer.

(*Abstract of Paper presented at the recent* NATIONAL ELECTRICAL MANUFACTURERS' CONVENTION, U.S.A.)

By F. H. ENGEL, Radio Corporation of America.

THE close relationship existing between radio-receiving-set and vacuum-tube design discloses two decided trends of development, namely, the ultimate elimination of all batteries from most receiving sets, and the utilisation of tubes specially designed for particular functions in the receiver. The achievement of a true "socket power"-operated receiver awaits the development of tubes specially designed for this purpose, and the Radio Corporation of America has developed four new "Radiotrons" which make more easily attainable the realisation of a completely a.c.-operated receiving set. Before describing the so-called "raw a.c." type of tube (*i.e.*, its filament may be operated directly from the house-lighting circuit by means of a suitable transformer) it might be well to state that the use of alternating current to heat the filaments of receiving tubes is not new, and the principles underlying its successful design are well known. The utilisation of low filament voltage alone is not sufficient to enable a receiving-tube filament to be satisfactorily operated on alternating current; rather, a fine balance between internal-element design and operating voltage and current is required.

"*Radiotron*" *UX*-226 incorporates an oxide-coated filament, having operating characteristics similar to those of "Radiotron" UX-201-A. Its nominal rating is as follows: Filament

volts, 1.5 V; filament amps., 1.05 A; plate volts (max.), 180 V; and its operating characteristics are :—

Nominal characteristics—			
Measured at Ep	180	135	90
Measured at Ec	13.5	—9-12	—6
Amplification factor	8.2	8.2	8.2
Plate resistance	7,000	7,400	9,400
Mutual conductance	1,170	1,100	875
Plate current	7.5	6-3.1	3.7
Plate current	7.5	6-3.1	3.7
Undistorted output as amplifier (watts)	0.16	0.07	0.02

Its maximum overall length is 4 11/16 in., and diameter 1 13/16 in., with a standard large "UX" base; the filament is very rugged and, since its operating temperature is quite low, it has exceptionally long life. A mica support prevents microphonic action and, at the same time, increases the general sturdiness.

The circuit requirements of the UX-226 are not greatly involved, the usual potentiometer grid and plate "return" being all that is required to balance out residual hum; filament power is supplied from the low-voltage winding of a step-down transformer having a ratio of 110 to 1.5. The tube cannot be used in existing radio receivers without making several changes in the set itself. It is recommended for use only in the radio- and audio-frequency amplifier stages of sets specially designed for the use of a.c. filament supply. The usual sources of plate and grid voltages are required, as with present-day tubes. Radiotron UX-226 may be used as a detector of moderate sensitivity, but the UY-227 is preferred for detector purposes.

"*Radiotron*" *UY*-227 is a receiving tube of the general purpose type, having electrical characteristics similar to the UX-201-A, from which it differs in that it is designed to use ordinary house-lighting (a.c.) power for heating the emitting element (cathode), but grid (C) and plate (B) batteries, or their equivalent in "socket power" devices, are required. A cathode, which is separate from the filament (heater) is used to supply the electron stream, and is heated to the proper emission temperature by the filament, which is very close to the cathode, but not in electrical contact with it. The heater (or filament) is energised by means of low-voltage alternating current supplied by a small step-down transformer without the introduction of "a.c. hum." It has a new standard 5-prong "UY" base, and the following nominal rating: Filament (heater) volts, 2.5 (a.c.); filament (heater) amperes, 1.75; plate volts (maximum), 180; while its operating characteristics are :—

Nominal characteristics—			
Measured at Ep	180	135	90
Measured at Ec	13.5	9	—4.56
Amplification factor	8.2	8.1	7.9
Plate resistance	9,400	10,000	11,300
Mutual conductance	870	820	725
Plate current	6.0	5.0	3.0
Undistorted output as amplifier (watts)	0.14	0.055	0.02

The use of "Radiotron" UY-227 in receiving sets designed for storage-battery tubes may be accomplished by the employment of special adapters and a small step-down transformer; such use eliminates the need of "A" batteries, although "B" and "C" batteries are required. The use of a "B" and "C" eliminator, in conjunction with the UY-227, makes possible the operation of receiving sets of present design direct from the electric lighting circuit; however, it is not believed that this use of the tube will become widespread, its main application being in the detector socket of new sets designed for a.c. operation.

"*Radiotron*" *UX*-280 is a full-wave rectifier of the oxide-coated-filament type designed primarily for use in heavy-duty "B" eliminators. A heavy-ribbon type of filament is used, and the plate has a specially treated surface which rapidly dissipates heat, the output being approximately three times that of the UX-213 full-wave rectifier. The electrical rating is: Filament volts, 5.0; filament amperes, 2.0; plate volts (between anodes), 600 (max.); d.c. output current, 125 mA (max.).

"*Radiotron*" *UX*-281 is a heavy-duty half-wave rectifier, the electrical rating of which is: Filament volts, 7.5; filament amperes, 1.25; plate volts, 750 (max.); max. d.c. output, 110 mA.

The "Radiotrons" described above are believed to meet the latest demands made by receiving-set design.

American Radio Patent Controversy Ended.

The *Wireless World* states that long and expensive litigation has been ended in the United States by an agreement which has been reached between the Radio Corporation of America and the Atwater Kent Manufacturing Co. Under the agreement 7½ per cent. of the sale price of all radio receiving sets manufactured by the latter company since January, 1923, and to be manufactured in the future will be paid to the Radio Corporation. The Corporation's claim was on account of basic patents in its possession.

Demonstrating Models.

Two electrical models designed for indicating the directions of currents and magnetic fields in and around the conductors of an alternator.

TWO demonstrating models which have recently been introduced, under provisional patents, by Dr. F. W. Alexander, late Medical Officer of Health for the Metropolitan Borough of Poplar, should prove useful in the electrical laboratory and lecture room. One of these is designed to illustrate the relative directions of flow of the currents in the stator and rotor of a 3-phase alternator, two essential parts of the

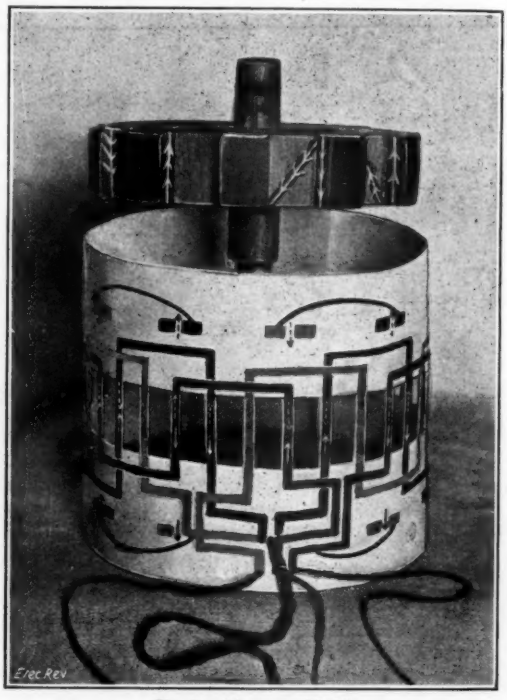


Fig. 1.—Alternator Model.

model representing these machine portions. The rotor, of wood or other material, is removable, and rotates upon a pivot on the base of the model. Projections on the circumference of the rotor represent the magnet poles and are suitably coloured to indicate the respective polarities. Arrowed lines indicate the direction of the currents in the field windings, and the connections between the poles. The slip rings and the connecting leads, with the directions of current flow, are also shown. The stator consists of a cylinder of suitable flexible

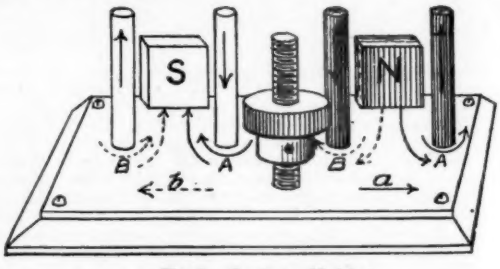


Fig. 2.—Conductor Model.

material attached to the circular base of the model and surrounding the rotor in position. The stator windings are represented diagrammatically on the external surface of the cylinder. By means of slots cut out between the phase conductors, the relative positions of the magnets and armature windings, and the field- and armature-current directions consequent on the direction of rotation of the rotor can be seen at a glance. Transparent material could be used for the stator element, so as to avoid the cutting of the slots. Above and below the stator windings are coloured areas representing the magnet pole pieces of the rotor, those at the top showing one polarity, and those at the bottom the opposite. Each area is divided into two parts, and an arrow between them indicates the direction of flow of the current in the stator conductors covered by the pole. The windings proper are also marked with arrows corresponding to those on the upper and lower magnets. The model should prove particularly useful when comparing single- and three-phase theory.

Fig. 1 is a view of the equipment with the parts separated;

it will be appreciated that the colours have disappeared in the process of reproduction.

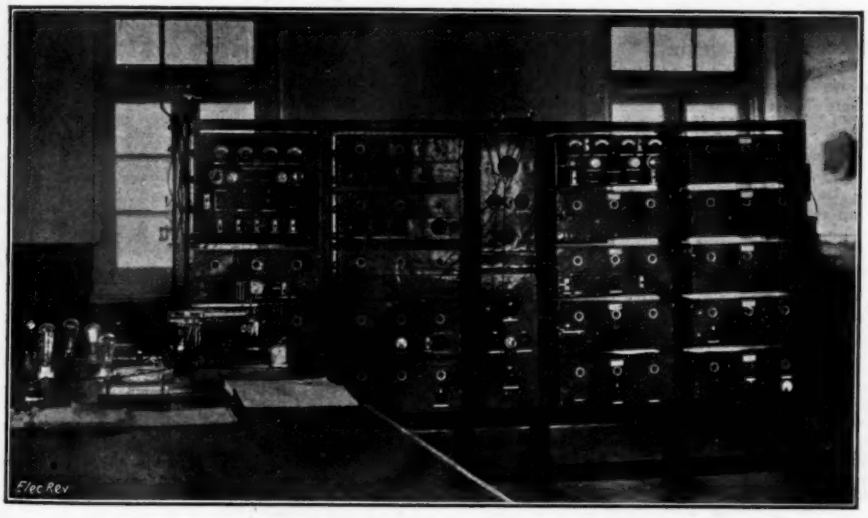
The second model may be described as a key to the first, showing the relative directions of the currents and magnetic field in any conductor. It consists of a flat base upon which upright pieces of suitable material are coloured to represent the North and South magnet poles. The magnetic lines of force between the poles are shown by arrows. On each side of each pole is an upright, coloured according to its position, two red and two blue. A circle described on the base around each upright depicts the direction of the field around the conductor, and an arrow on the upright represents the direction of current flow in the conductor. Upon the base in front of the uprights arrows, A and B, denote the movement of the magnetic fields. These arrows can be made movable. At the front of the base is a threaded upright and nut. By comparing the direction of the movement of the nut with that of the magnetic lines of force, indicated by the various arrows, the direction of the current in the conductors is readily and easily indicated by the arrows *a* and *b*.

Fig. 2 shows the arrangement of this model, which is made up in the form of a paperweight and can be obtained from Messrs. Beagley & Musto, 2, Bedale Street, London Bridge, S.E.

Wireless "Beam" Communication.

The short-wave wireless telegraph service on the "beam" system between England and India has now been completed and put into operation.

THE short-wave wireless "beam" stations which have been built for the General Post Office by Marconi's Wireless Telegraph Co., Ltd., at Grimsby and Skegness, for high-speed wireless communication with India, have successfully passed their seven days' official Post Office test, and the company has been informed by the Post Office that it is issuing the preliminary certificate of acceptance. The radial "beam" services between Great Britain and Canada, Australia, South Africa, and India, have thus been successfully completed, and the British Empire now possesses the most complete, up-to-date and efficient wireless telegraph service in the world. The peripheral services between the respective Dominions remain to be completed.



Interior of Receiving Station at Dhond, India.

Under the Government contract with the Marconi Company, the "beam" stations for communication with India were to be capable of sending and receiving at the same time at a minimum speed of 100 words per minute during a daily average of twelve hours. During the seven days' official test this guarantee was largely exceeded, the Marconi Company estimating that an average speed of between 130 and 150 words per minute was maintained during from 18 to 21 hours per day. As a result of the tests it is also estimated that the capacity of the Indian "beam" circuit is about 180,000 words per day in each direction. It is well known that during the monsoon period India is one of the worst countries in the world for atmospheric interference; hence the fact that the Indian "beam" stations have been able to work at high speed for hours on end during that period is a remarkable testimony to the freedom from atmospherics that is obtained by the use of "beam" receiving aerials.

The achievements of the Indian stations during the tests bear out the experience of the working of the other beam stations. Mr. E. T. Fisk, the managing director of the Australian Wireless Company, has estimated, for instance, that the high-speed capacity of the Australian circuit working in both directions for the four weeks from July 11th to August 7th was 701,200; 642,750; 816,286; and 983,022 words respectively. The circuit capacity shown by these figures is considerably in excess of the total telegraphic traffic passing between Australia and England at the present time.

Although the South African service has only been open since the beginning of July, the traffic has shown a rapid and continued increase and is already considerably greater than was expected at such an early date; its capacity is estimated to be far greater than the total traffic at present passing between South Africa and England.

We are informed that within a few weeks there will be a further development in the opening, by Marconi's Wireless Telegraph Co., Ltd., of commercial "beam" telegraph services between England and South America, and between England and the United States of America. The "beam" stations for direct communication between Canada and Australia are also nearing completion, and this service is expected to be opened in the near future.

Although the erection of the Indian "beam" stations completes the contract into which the Marconi Company entered for erecting stations for Imperial wireless telegraph communication for the British Government, it by no means completes the immediate prospect of improving communication between Great Britain and her Dominions, experiments having proved the possibility of carrying on wireless telephone conversation by means of the "beam" stations simultaneously with the operation of high-speed wireless telegraph services. There is every prospect that before the end of next year it will be possible for telephone subscribers in England to call up subscribers in any of the Dominions.

With the development by the Marconi Company of a system of facsimile transmission, specially adapted to the "beam" system, there is also a prospect of written and printed matter, drawings, and photographs being transmitted by high-speed wireless telegraphy.

The English transmitting station of the Indian service at Grimsby, and the receiving station at Skegness, are connected, as is the case with the other "beam" services, by landlines to the Central Telegraph Office at the G.P.O. in London, from which the actual operation of the station is automatically controlled. The corresponding transmitting station in India, which is situated at Kirkee, near Poona, 75 miles east of Bombay, and the receiving station at Dhond, 48 miles east of Poona, are similarly linked with the Central Telegraph Office in Bombay, so that the English and Indian terminal offices are in immediate touch with each other; messages placed in the high-speed signalling instruments at the G.P.O. in London are instantly recorded at the Bombay office, and *vice versa*.

The transmitting installation at Grimsby for the England-India service is in the same room as the transmitter for the England-Australia service. Transmission to India takes place on wave-lengths of 16.216 and 34.168 metres, and from India to England on 16.286 and 34.483 metres. At Grimsby a five-mast aerial system, quite distinct from the three-mast aerial system of the Australian service, has been built. The masts are 277 feet in height, with a distance of 650 feet between them. Two bays are used for one wave-length, and the other two bays for the second wave-length. The masts are erected in a straight line at right angles to the great circle from the transmitting station at Grimsby to the receiving station in India, and the reflector behind the active aerials focuses the main energy in a south-easterly direction on to the receiving aerials in India. A similar aerial system has been built at Kirkee to carry out the transmissions to this country.

The receiving apparatus for the signals from India is installed at Skegness in the room where the receiver for the

reception of the signals from Australia is installed, as illustrated in our description of the Australian service (Electrical Review, April 22nd, 1927, p. 627). The aerial and reflector system built at Skegness for the reception of the Indian signals is similar to the system at Grimsby.

The receiving station at Dhond in India is identical in design with the Skegness receiving station. There is, however, an interesting modification in the method of automatically controlling the transmitter and receiver of the stations built in India. The normal method of controlling the transmitting apparatus of the "beam" stations in England is by means of a high-speed Wheatstone transmitter, installed in the Central Telegraph Office in London, which sends ordinary telegraph signals along the landline to a relay on the "beam" transmitter, which in turn keys the transmitting apparatus. In the case of the stations built in India, however, the system of control known as "wired wireless" has been adopted; that is, instead of ordinary landline telegraph signals being used for the control of the stations, signals of wireless frequency are generated and sent along the landline. By adopting frequencies sufficiently wide apart, it is possible to work a number of control services on a single landline, in addition to which one or more telephone conversations may be conducted by means of the same landline, without mutual interference.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Phasing-in on Three-phase Systems.

With reference to the contribution in the current issue of the Electrical Review by Mr. G. H. Bowden, I am sure that the information given will be welcomed and much appreciated by many engineers when "phasing-in." There is one point which Mr. Bowden has omitted in conjunction with his very interesting article, and that is that the l.p. connections in fig. 9 are not suitable for low-pressure machines having earthed neutrals. When paralleling-in l.p. machines with earthed neutrals, lamps should be inserted in each phase, and one phase not solidly connected as shown; otherwise if the phase rotation of one machine is opposed to the other, the solid link will be subjected to short-circuit conditions under an applied voltage of $2 \times \sqrt{3}$ of line voltage.

Ernest Whitby.

Birmingham, *September 2nd*, 1927.

In the article by Mr. Bowden on phasing-in, it is not made clear that A, B and C phases are only relative terms; any one set of coils, &c., can be A, B or C phase, but when you have fixed, say, A, then B and C will have their correct rotational positions. If you take any two phases, they are either leading or lagging to the third phase, for in 3-phase circuits the fundamental (open-circuit) pressure impulse must fix the term lead or lag for the current flowing; in fact, the phase currents can be in phase with each other, depending on the condition of the power factor in each single phase, or, in other words, it is the same current in each phase. The old definition of the leading, or lagging, phase being that in which the pressure leads or lags behind the current is apt to cause engineers to overlook the fact that it is the mechanical arrangement of the windings on the generator which fixes the lead and lagging phase. Those who require sketches and diagrams are usually weak on first principles; for instance, take a delta-star transformer, a diagram would not show that the primary and secondary of any phase were on the same leg of the magnetic circuit (or pancaked). Take any terminal on the primary and note the terminal nearest to it of the secondary winding on the same leg; call these the "incoming" (+) and the other terminals of the same coils the "outgoing"; do this for the 3 phases, being careful in each phase to give the name "incoming" to the same ends of each set of coils, and then follow round the connections in mechanical order, joining the incoming and outgoing for delta and all "outgoing" for star. The neutral point is the point where pressure impulses neutralise each other. Manufacturers *might* make a mistake and engineers should check this up for themselves; with the clear oil now used in transformers, this is easy. Wiring faults are mostly due to faulty intermediate jointing, so that engineers should *personally* see the wiring run through *before* joining up.

When there is a running system to consider the phase names are mechanically, or conventionally (not electrically) fixed: for instance, a certain system has its yellow phase earthed, but in any apparatus on the system, even after a run, the earth can be altered to any main terminal, the other two terminal connections moving round the same in amount and direction, without affecting the mechanical rotation or indication of the instruments, although, possibly, a 5 per cent. calibration error may be introduced into the watt-meters. This is pointed out as it is sometimes puzzling to see two generators of the same make and design which have been running for a time with the secondaries of their instrument circuits connected up the same, while on the h.p. side (main leads) the middle terminal of one is joined to an outer terminal of the other. Thus it is necessary that after the correct rotation is established the relative mechanical position of the terminals be checked, for if the connections are broken later for alteration or repairs a mistake might be made in reconnecting, as was the case when a motor which was directly coupled to a machine reversed and did damage to some material after a meter had been changed in a distant part of the building. By inspection of the windings mechanical rotation can be deduced, and by connecting the leading phase of the system to a terminal which *you* have made leading on the motor correct rotation can be insured. If you desire a certain terminal to be leading write down the phase rotation several times as follows: (1) Blue, (2) white, (3) red, blue, white, *red, blue, white;* then by marking off any three, mark your terminals by these three marks in the same rotation as above (1) *red*, (2) *blue*, (3) *white*. Thus red is moved from terminal (3) to terminal (1), but there is still the same rotation.

Ilford, *September 5th*, 1927. **W. J. Minton.**

A New Association of Valve Manufacturers.

Many wireless enthusiasts know that it is possible to buy radio valves at prices below those at which some of the best known valves are sold, but until now doubt of their efficiency has been prevalent largely owing to the importation of cheap and imperfect Continental valves. At a meeting held in London recently, and attended by several important British manufacturers, it was decided to form a new association, to be known as the Association of British Independent Valve Manufacturers. The objects of this Association are to protect the public from high prices, and defective foreign valves, and to give assurance that all valves manufactured by members of the Association are made in sufficient quantities to meet any demand which may arise. Members will not be restricted in any way as to the price at which they market their own products, and it is their intention individually to offer the public the benefit of all economies they can effect in manufacture.

A. H. Clifford,
Hon. Secretary.

70, Finsbury Pavement, E.C.2.
August 31st, 1927.

Domestic Water Heating.

I am interested in your leading article of August 26th, under the above heading, because it points to a difficulty I have been hammering at for some years. It is not uncommon to find undertakers who are buying on a maximum-demand basis in difficulties in basing their rates to domestic consumers.

As you know, I have advocated in your columns several times the two-rate system, which is the only one which really encourages off-peak uses and enables a distributor to be quite certain that he is selling on the same basis at which he is buying—that is, of course, if he does both on this system.

I am glad to say from my own knowledge that this view is spread very generally not only in this country but all over the world, and that the two-rate system, which was unfortunately first introduced before its time, is now coming into its own.

Ernest E. Sharp.

London, *August 30th*, 1927.

A Two-Rate Meter.

I read with interest the letter of "Simplicity" in the current issue of your paper. The call for simplicity in metering is most commendable. Many suggested improvements are set aside, because of the increased cost of production of new devices, which is felt during the period between their introduction and their wholesale application. The cost of power supplied to the consumer depends on the load factor, and on the time of day at which his peak load occurs. Existing tariffs are designed to estimate as closely as possible the true cost of giving a supply. Such a device as has been suggested has the effect of encouraging a load with a high peak, which is entirely a wrong principle. The complication of some tariffs as they appear to the individual consumer is greatly relieved in the clerical departments of the supply company by the use of ready reckoners, curves, &c., to suit each tariff.

The introduction of a method of charging that is dependent on the accuracy of a second device of lower accuracy than the normal watt-hour meter is undesirable, and it seems essential to employ two devices in a meter of the suggested nature, *i.e.*, one to measure demand and a second to measure total consumption.

Rather than combine the functions of existing metering arrangements in one meter by the adoption of a new meter mechanism, I would suggest the following method of securing simplicity in metering combined power and lighting loads:—

One meter of standard construction could be provided with two circuits in the current coil, one circuit being connected to the lighting load, and the other to the power load, the ratio of turns in the respective circuits being proportional to the ratio between the prices per unit for the two classes

of load. Alternatively, a normal meter could be supplied from a current transformer having two primary windings, each primary being connected to its separate load and having a suitable turn ratio. The simplicity gives the impression that the idea cannot be new, and probably has been previously put forward.

G. H. Bowden.

Newcastle-on-Tyne, *September 3rd*, 1927.

Rural Electric Lines.

I note the proposals of Mr. Fennell in your issue of September 2nd. According to the Regulations, double insulators have to be used for h.p. roadside lines; as a rule on the Continent and in America, up to about 25,000 volts the bulk of the lines are beside the roads. If one takes the mileage-years of experience with rural lines in several Continental countries as compared with our own, the ratio is about 100 to 1; that being so, as I believe that no other country asks for doubled insulators for roadside h.p. or l.p. lines apart from road crossings, why should it be necessary with us? Regarding height, in many countries an earth wire is the exception; many lines are built in a triangular form, point upwards; this tends to reduce pole length. The usual clearance is based on temperature, not on ice loading. Regarding crossings, doubled conductors are being abandoned as unnecessary, and doubled insulators with a higher factor of safety for the line at the crossing (that is to say, usually a shorter span) are found by experience to be sufficient. In France, to prevent progress being obstructed, regulations are subject to periodical revision after examination by the Electrical Committee, and the Post Office is instructed to co-operate and rearrange its lines where feasible.

Some of those who assisted in the preparation of our regulations proclaim that they compare favourably with those in foreign countries; the point is, however, that many such regulations have been modified by official circulars, or modifications have been allowed locally to enable inexpensive constructions to be adopted. It is one thing to read and compare printed regulations and quite another to go abroad and discuss some of the fundamental points with officials and engineers.

In this country every year there are a number of fatalities in workshops and inside houses owing to the use of 230 to 250 volts alternating to earth, whereas abroad 110-125 volts to earth is the rule; on the other hand, the powers that be have dealt with h.p. or l.p. overhead lines as if in a blizzard the inhabitants of a village turn out and sit in a row by the roadside and wait for the line to fall on them.

Mr. Fennell is to be congratulated for the way in which he has been hammering at the problem of cheapening rural supply lines; there is still, however, a long way to go.

Theodore Rich.

Woldingham, *Sept. 4th*, 1927.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1926.

7,079. "Manufacture of multi-core electric cables." C. J. Beaver and W. T. Glover & Co., Ltd. March 13th, 1926. (275,683.)

8,740. "Current motors." V. Banddelj. March 31st, 1925. (250,243.)

9,118. "Electric lamp shades or the like." J. P. Brown, H. Brown, and C. H. Brown. December 28th, 1926. (275,691.)

9,318. "Electric motors." Naamlooze Vennootschap de Verenigde Ijzerfabrieken. May 6th, 1925. (251,954.)

9,325. "Electric relay switches." E. C. R. Marks (Williams Oil-O-Matic Heating Corporation). April 8th, 1926. (275,693.)

9,326. "Road-traffic signalling systems." E. C. R. Marks (General Street Signal Corporation). April 8th, 1926. (275,694.)

9,631. "Radio dials." J. W. Dyer. April 25th, 1925. (251,260.)

11,433. "Electric motor control." British-American Laundry Machinery Co., Ltd. (American Laundry Machinery Co.). April 30th, 1926. (275,702.)

11,796. "Steering of vehicles, for example, those of tractor trains, or railway or tramway trains." H. W. Johkhoff. May 5th, 1926. (Cognate applications 22,126/26 and 29,021/26.) (275,704.)

11,938. "Electric contact plugs, couplings, terminals and the like." A. E. Chapman and C. R. Cook. May 7th, 1926. (275,708.)

11,964. "Relay interrupters for automatic telephone plants." E. C. R. Marks (C. Lorenz Akt. Ges.). May 7th, 1926. (275,709.)

12,062. "Current-rectifying apparatus." L. H. Peter and Westinghouse Brake and Saxby Signal Co., Ltd. May 10th, 1926. (275,713.)

12,068. "Keyboard arrangements for automatic or semi automatic telephone plants." E. C. R. Marks (Automatische Fernsprech Anlagen-Bau-Ges.). May 10th, 1926. (275,715.)

12,090. "Fault signalling means for automatic telephone plants." Automatische Fernsprech Anlagen-Bau-Ges. May 25th, 1925. (252,355.)

12,092. "Visible indicating means for automatic or semi-automatic telephone plants." Automatische Fernsprech Anlagan-Bau-Ges. July 27th, 1925. (255,825.)

12,129. "Processes for producing metals in electric furnaces." E. G. T. Gustafsson. May 16th, 1925. (252,162.)

12,193. "Means for passing current into and securing the electrodes in metallic vacuum discharge vessels." Dr. W. Dallenbach. May 27th, 1925. (252,698.)

12,204. "Manufacture of insulated electric conductors." Standard Telephones and Cables, Ltd., and T. N. Riley. May 11th, 1926. (275,721.)

12,304. "Electromagnetic relays." Automatic Telephone Manufacturing Co., Ltd., and H. Adams. May 12th, 1926. (275,728.)

12,305. "Polarised relays." Automatic Telephone Manufacturing Co., Ltd., and H. Adams. May 12th, 1926. (275,729.)

12,386. "Butting switchboard cables." Standard Telephones and Cables, Ltd. (Western Electric Co. Inc.). May 13th, 1926. (275,732.)

12,398. "Manufacture or construction of loud-speakers or sound-amplifiers." U-Phone Co., Ltd., and R. Burrill. May 14th, 1926. (275,733.)

12,442. "Electric incandescent lamps." General Electric Co., Ltd., and C. J. Smithells. May 14th, 1926. (275,735.)

12,443. "Moulded articles." General Electric Co., Ltd., and R. J. Kaula. May 14th, 1926. (275,736.)

12,722. "Arms and brackets for attachment to poles." J. Spencer, Ltd., and Sir T. H. Spencer. May 18th, 1926. (275,742.)

13,065. "Electron-discharge tubes." Siemens-Schuckertwerke Ges. June 15th, 1925. (253,505.)

13,368. "Electrical storage batteries." C. J. V. Fery. May 20th, 1926. (275,750.)

13,384. "X-ray tubes." H. Wade (Naamloose Vennootschap Philips' Gloeilampenfabrieken). May 26th, 1926. (275,751.)

13,438. "Electrically-operated indicating and signalling apparatus." L. J. J.-B. Cheneau. June 19th, 1925. (253,881.)

13,862. "Mercury vapour rectifier installations." Siemens Schuckertwerke Ges. June 27th, 1925. (254,286.)

15,552. "Adaptor for electric pendants and the like." A. Tullett. March 14th, 1927. (275,759.)

15,933. "Acoustic instruments such as loud speakers." Marconi's Wireless Telegraph Co., Ltd. June 25th, 1925. (275,326.)

16,759. "Electric discharge apparatus for converting electric currents." L. A. Hazeltine. July 28th, 1925. (256,198.)

17,109. "Sound-amplifying devices used in wireless telephony." R. E. Worsley. July 8th, 1926. (275,770.)

17,137. "Wireless transmitting systems." N. F. S. Hecht and G. Morton July 8th, 1926. (275,771.)

17,449. "Supporting device for telephone apparatus." Brevex Soc. Anon. March 4th, 1926. (Addition to 255,854.) (267,077.)

17,844. "Electromagnetic interrupters or make-and-break devices." F. E. Kewley and Bower Electric (1926), Ltd. July 16th, 1926. (275,777.)

19,197. "Electric regulators." W. E. Beatty (Bell Telephone Laboratories, Inc.). August 3rd, 1926. (275,784.)

19,266. "Electrolytic apparatus." W. G. Allan. August 4th, 1926. (275,785.)

20,338. "Electric globe holders." A. McKellar. August 18th, 1926. (275,794.)

20,410. "Conduit fittings." A. E. White (Erie Malleable Iron Co.) August 18th, 1926. (275,796.)

20,564. "Radio signalling apparatus." R. Annan. August 20th, 1926 (275,797.)

21,441. "Electric condensers for use in wireless apparatus." C. D. Melhuish. August 31st, 1926. (275,800.)

21 736. "Protection of electric circuits." British Thomson-Houston Co. Ltd. September 14th, 1925. (258,252.)

21,899. "Labels for electric accumulators." H. T. Laslett. September 6th, 1926. (275,803.)

24,087. "High-tension voltage-measuring apparatus." M-L Magneto Syndicate, Ltd., and J. A. Laird. September 29th, 1926. (275,814.)

25,290. "Electron-discharge apparatus." British Thomson Houston Co., Ltd. October 10th, 1925. (259,614.)

27,620. "Galvanic batteries." Oldham & Son, Ltd., and H. E. Clarke. November 3rd, 1926. (275,832.)

29,146. "Stuffing boxes and the like." General Electric Co., Ltd., and C. C. Garrard. November 18th, 1926. (275,838.)

29,425. "Telephone receivers." G. Kiernan. November 22nd, 1926. (Cognate applications 4,445/27 and 6,202/27.) (275,841.)

31,561. "Reproduction of pictures and the like." Marconi's Wireless Telegraph Co., Ltd. December 12th, 1925. (262,821.)

32,696. "Storage and utilisation of electrically-generated heat." P. Seehaus. December 24th, 1925. (263,827.)

32,871. "Means for supporting reflectors, galleries, and like fittings on lampholders or the like." G. Campbell and E. Fowler. December 29th, 1926. (275,852.)

32,873. "Device for varying the temperature coefficient in induction meters by means of bi-metal strip acting as a self-adjusting reluctance in the magnetic shunt." Landis & Gyr Soc. Anon. January 29th, 1926. (265,158.)

33,035. "Selectors for telephone systems." Telefon-und Telegraphenbau-Ges. and A. Heibel. December 31st, 1926. (275,856.)

1927.

1,702. "Electric condensers." Dubilier Condenser Co. (1925), Ltd. June 24th, 1926. (273,240.)

2,539. "Eddy-current tachometer." F. H. Rogers (Ota Apparate-Ges.). January 28th, 1927. (275,866.)

2,321. "Electric fires." C. Tabrisky. February 5th, 1927. (275,871.)

3,685. "Electrically-driven centrifugal separators." H. O. Corlett. May 6th, 1926. (266,693.)

4,737. "Electric incandescent lampholders." J. Marek and Dr. A. Ember. July 15th, 1926. (274,415.)

4,867. "Electronic discharge apparatus." Soc. La Radiotechnique. April 21st, 1926. (269,861.)

4,981. "Arc lamps." C. Schorr, F. Kunze and Chemische Fabrik Auf Actien (Vorm. E. Schering). February 22nd, 1927. (275,879.)

5,887. "Electric resistance measuring instruments." Siemens & Halske Akt. Ges. March 20th, 1926. (267,910.)

6,342. "Retarded overload relay or tripping device for electric circuit-breakers and the like." Ateliers de Constructions Electriques de Charleroi April 19th, 1926. (269,496.)

6,962. "Substitute resistance for electric lamps to be connected in series." A. Lampl. March 13th, 1926. (Addition to 249,048.) (267,553.)

7,569. "Brake current-indicator for electrically-driven vehicles and such like." Dr. P. Meyer Akt. Ges. April 3rd, 1926. (268,755.)

10,185. "Mounting of inspection windows in electricity meters and like instruments or apparatus." Landis & Gyr Soc. Anon. May 29th, 1926. (271,835.)

10,809. "Auto-transformers having variable transformation ratios." P. Stragiotti. April 22nd, 1926. (269,915.)

11,074. "Thermionic valves." Siemens & Halske Akt. Ges. April 24th, 1926. (269,945.)

12,229. "Signalling apparatus for railways." R. Gross. May 6th, 1927. (275,909.)

16,378. "Thermionic valves." C. Tourne. June 22nd, 1926. (273,293.)

16,177. "Cascade-connected commutator machines for asynchronous induction machines." Siemens-Schuckertwerke Ges. June 18th, 1926. (Addition to 240,831.) (272,950.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 31st:—

Gloverite. No. 478,435. All goods in Class 8. No. 478,436. All goods in class 13.—W. T. Glover & Co., Ltd.

Interdyne. No. 482,015. Class 8. Radio-telephonic and telegraphic receiving apparatus.—Radio Instruments, Ltd.

Stal (lettering and design). No. 479,685. Class 8. Apparatus for use in radio-telephony and telegraphy, but not including detector crystals or goods of a like nature.—Lester & Co., Ltd., 69, Moorgate, E.C.2.

Terralto. No. 482,343. Class 8. Instruments, apparatus, and parts thereof for use in radio-telephony and telegraphy.—Reginal Custerson, 11, Kingsville Gardens, Eastern Avenue, Ilford.

B.T.H. (lettering and design). No. 482,446. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—British Thomson-Houston Co., Ltd.

Impervite. No. 478,871. Class 50. A material for electrical insulating purposes, &c.—Ruberoid Co., Ltd., 296-302, Holborn Viaduct, E.C.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABINGDON.—School for 200; Church of England school managers.

BARNSLEY.—Club premises, for the Conservative Club; N. A. Whitham, architect, 10, Regent Street.

BERKSHIRE.—Accommodation for mental defectives; Special Committee of County Council.

BILLINGHAM.—Housing scheme (100), for the U.D.C.; Kitching & Archibald, architects, 21, Albert Road, Middiesbrough.

BIRMINGHAM.—Roman Catholic church, Perry Common; Rev. J. Faulconer Morgan, priest-in-charge. 400 houses, Fox Hollies Estate; city engineer.

BRIDPORT.—Extensions, Secondary School; Education Committee.

BRISTOL.—Extensive alterations, Castle Street, for M. J. and F. Spackman.

BURNHAM (BUCKS.).—Operating theatre, Sanatorium; for the governors of Eton College.

BURNLEY.—School, Rosehill Estate; director of education.

BUXTON (NORFOLK).—Estate development; Sir Edward Stracey.

CARBIS BAY (CORNWALL).—Church (£12,000); Mr. Wheatley, architect.

CHAPEL-EN-LE-FRITH.—Cement works, Hope Valley, for G. & T. Earle, Hull.

CHATHAM.—Engineering services for heating, &c. (£23,400), for the Medway B.G.; clerk.

CHELTENHAM.—20 houses, Corporation estate; Mr. W. Drew. Extensions, dust destructor; borough engineer.

COLCHESTER.—Church, Culver Street, with electrical work, for the Wesleyan trustees; A. Brocklehurst & Co., architects, Manchester; J. W. Trudgett, builder.

DARLINGTON.—Works, Cockerton, to be electrically equipped, for the Chemical and Insulating Co., Ltd.; Melville, Dundas & Whitson, contractors, Glasgow; A. Glendinning, manager.

DARWEN.—School, Avondale Road., for the Borough E.C.; director of education.

DOWNHAM.—Secondary school, Norfolk Education Committee.

DUMFRIES.—Garage (£2,500), for Caledonian Omnibus Co.; the manager. Alterations and additions, High Street, for Robinson Bros. (Carlisle), Ltd.

DUNOON.—Alterations and adaptations at Post Office and Telephone Exchange; H.M. Office of Works, 122, George Street, Edinburgh.

EASTBOURNE.—40 houses, Victoria Drive; Messrs. Gilbert Bros., Broadstairs.

EAST GRINSTEAD.—32 houses, Three Bridges Estate; R.D.C. surveyor.

EDINBURGH.—Reconstruction of Empire Theatre; W. and T. R. Milburn, architects, Sunderland.

FARNHAM ROYAL (BUCKS.).—Factory, for Slough Estates, Ltd.

GLASGOW.—New offices for Scottish Legal Life Assurance Society in Bothwell Street; Wright & Wylie, architects, 203, West Regent Street. 172 houses at Knightswood, for Corporation Housing Department; city architect. Addition at Glasgow School of Art (£27,500); the director. Buildings for St. Andrew's Ambulance Association; the secretary.

GLOUCESTER.—Garage and petrol station, Westgate Street, for C. Healey & Son (1927), Ltd.

GOOLE.—Roman Catholic Mission Hall; rector of St. Joseph's.

GREENOCK.—Auxiliary hospital, Kip Valley (£60,000); Abercrombie & Maitland, architects, Paisley.

HARTLEY WINTNEY (HANTS.).—Extensions to infirmary, nurses' home, and new mortuary, for the B.G.; Owen A. J. Goddard, architect, Finchampstead, Berks.

HAVANT.—200 houses for the U.D.C.; Council surveyor.

HEAGE (DERBYSHIRE).—Housing scheme (25) for the U.D.C.; A. J. Fortnam, surveyor.

HOLT.—Senior school; Norfolk Education Committee.

HORTON.—Nurses' home, Mental Hospital (£20,000); H. H. and F. Roll, builders, Epsom.

IPSWICH.—Depôt and headquarters garage, St. Helen's Street; East Suffolk county surveyor.

IRISH FREE STATE (TRALEE, Co. KERRY).—Secondary school for the Christian Brothers (£23,000); Mr. Sisk, builder, Cork.

KINGSTON-ON-THAMES.—Bank premises, corner of London Road, for the Westminster Bank, Ltd.

KNARESBOROUGH.—Alterations and additions to Institution, Stockwell Road; S. Blenkhorn, architect, Westminster Bank Chambers.

LANGLEY MARISH (ETON).—Extensions, Actors' Orphanage; secretary. Business stores, for the Slough Co-operative Society, Ltd.

LONDON (CLERKENWELL, E.C.).—Extensions, St. Luke's Hospital; Moore & Sons, Yarmouth, for Metropolitan Asylums Board.

(WOOLWICH, S.E.).—Boys' secondary school, Shooter's Hill, for the London E.C. Extensions and reconstruction of premises, Eltham, Lewisham, Peckham Rye, and Rushey Green, for the Royal Arsenal Co-operative Society; secretary.

(HOLBORN, W.C.).—New buildings site of 10, 12 and 14, Macklin Street; Nicholas & Dixon-Spar.

LONGTON (STAFFS.).—Children's ward, Cottage Hospital; Beckett & Bloore, architects.

MANCHESTER.—Development of Wythenshawe Estate for houses; Barry Parker, designer of Letchworth Garden City.

NEW CUMNOCK (AYRSHIRE).—Business premises for A. Kirkland, draper, and Mr. Condie, baker (several thousand pounds).

NEWHAVEN.—Power station, for the Newhaven and Seaford Electricity Supply Co., Ltd.

NORTHERN IRELAND (NEWRY, Co. DOWN).—40 houses for the U.D.C.; surveyor.

NORTHFLEET.—Housing scheme, Wombwell Hall Estate; U.D.C. surveyor.

NOTTINGHAM.—800 houses, Bulwell Hall Estate; city engineer.

PETERBOROUGH. — Children's Cottage Homes, South Parade, for the B.G.; I. Whitsed, clerk. Municipal buildings, Narrow Street, and police and fire stations, for the T.C. (£160,000).

PONTEFRACT.—Factory, Mill Dam, for Wilkinson, Ltd.; Hustler & Taylor, architects, Ropergate.

POOLE.—Housing scheme (£53,125), for the Town Council.

PRESTON.—Housing scheme (450), Callons House Farm site, for the T.C.; W. Platt, borough engineer.

RETFORD.—Re-erection of mill, for Wilmot & Birkett, millers.

ROYTON.—Central school; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

RUGBY.—Extensions, Technical School; Warwick county architect.

RUSHDEN.—50 houses, Irchester Road; U.D.C. surveyor.

ST. IVES.—Town hall; Special Corporation Committee.

ST. LEONARDS.—Carriage depôt (£60,000), for the Southern Railway.

STOKE-ON-TRENT.—50 houses, Water Street, for Michelin Tire Co.; city engineer.

SKEGBY.—Electric light installation, 52 houses, for the R.D.C.; surveyor.

SOUTH SHIELDS.—Barge loading refuse conveyor and mechanical equipment; S. G. Stanton, borough engineer.

SPENBOROUGH (YORKS.)—Additional 70 houses, Gomersal, for the U.D.C.; surveyor, Cleckheaton.

SUTTON COLDFIELD.—Secondary school for girls; Warwick county architect.

THORNTON HEATH.—Boys' secondary school, for Croydon Borough E.C.; W. H. Ashford, architect.

TYNEMOUTH.—28 houses, Percy Street; Mr. J. Carruthers. 'Bus garage extensions, Percy Main; Electric Traction Co., Ltd. Reconstruction, workshops, Howard Street; Tynemouth Blind Welfare Society. 32 houses, Foxton Avenue; F. R. N. Haswell & Son.

UXBRIDGE.—Electric lighting, Bandstand, Fassnidge Park; U.D.C. surveyor.

WILNCOTE.—Mining school; Warwick county architect.